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Technical Note N-986

AIRFIELD PAVEMENT EVALUATION, ROYAL THAI NAVY STATION, BAN U-TAPAO AIRFIELD, THAILAND

by

D. J. Lambiotte and R. B. Brownie

August 1968

NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California

64

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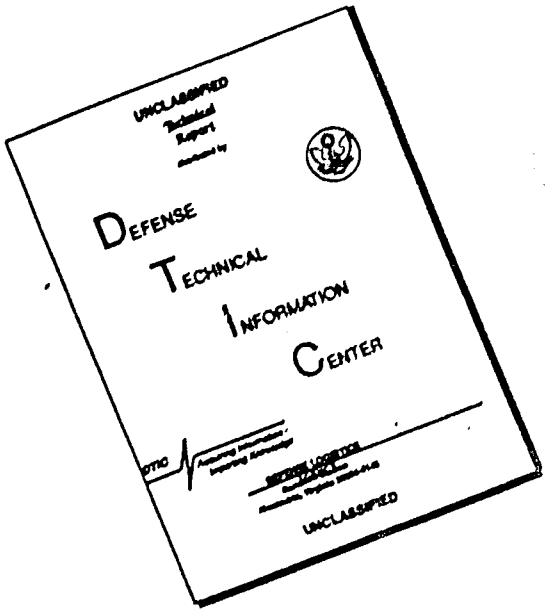

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AIRFIELD PAVEMENT EVALUATION, ROYAL THAI NAVY STATION, BAN U-TAPAO AIRFIELD, THAILAND

by

D. J. Lambiotte and R. B. Brownie

ABSTRACT

The evaluation of the pavement at the Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand is presented with the allowable gross load capacities of all airfield pavements for various aircraft gear configurations. Included is a narrative-type pavement condition survey with a defect summary and supplementary photographs.

CONTENTS

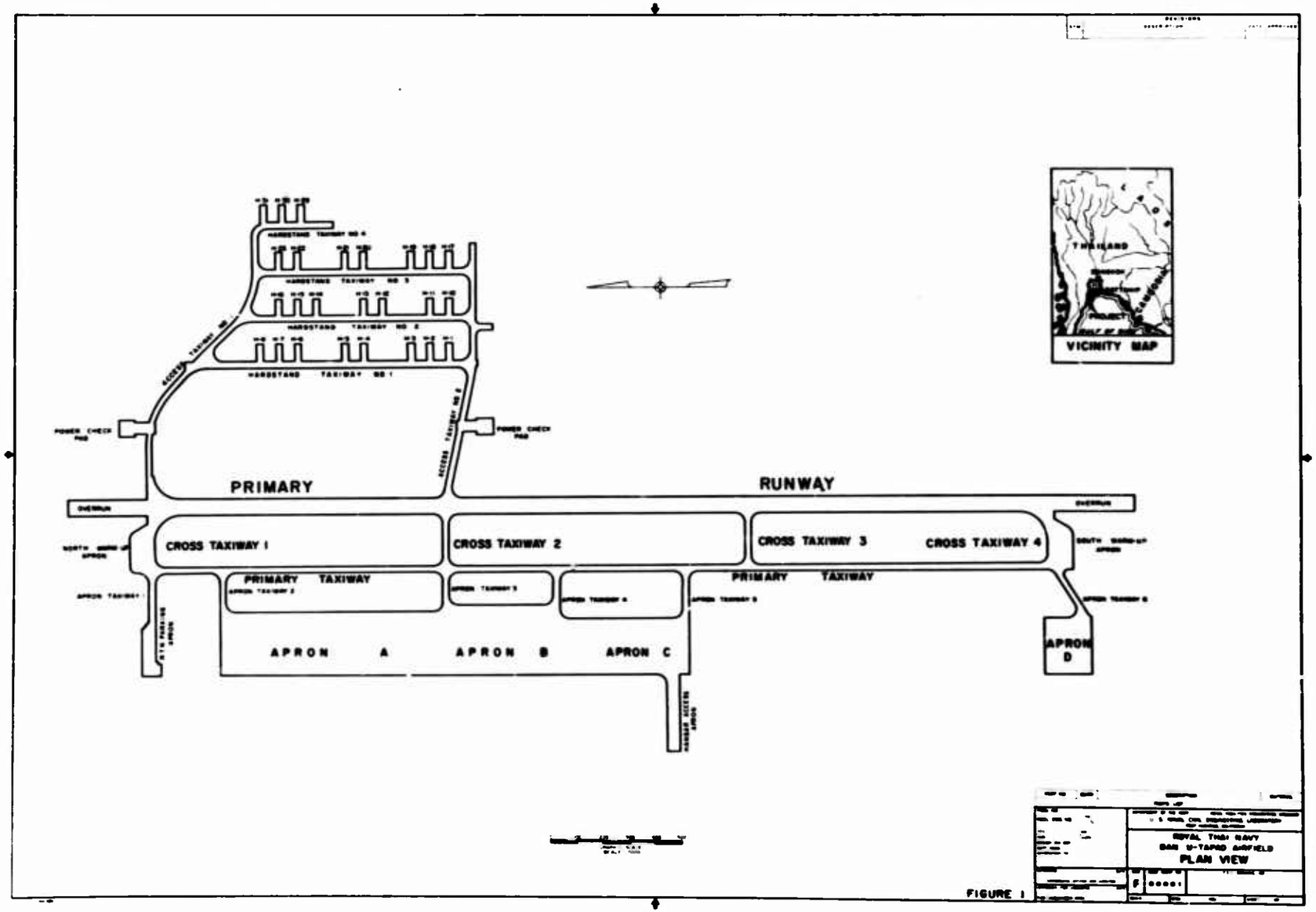

VICINITY MAP
PRIMARY
RUNWAY
CROSS TAXIWAY 1
CROSS TAXIWAY 2
CROSS TAXIWAY 3
CROSS TAXIWAY 4
PRIMARY TAXIWAY
PRIMARY TAXIWAY
APRON A
APRON B
APRON C
APRON D
ROYAL THAI NAVY
U-TAPAO AIRFIELD
PLAN VIEW

FIGURE 1

BACKGROUND

Ban U-Tapao Airfield is located at longitude 12°-40'-40" North, latitude 100°-00'-33" West, approximately 130 kilometers by air southeast of Bangkok, Thailand. The altitude of the field is 12.84 meters above mean sea level at the centerline of the runway.

GEOLOGY

The airfield is situated on the alluvial plains of the southeast coastal region of Thailand which is bounded on the west and south by the Gulf of Thailand, on the east by the flat-topped hills of the Banthat Range and on the north by the hills and mountains along the southern edge of the Prachin River valley.

The flat coastal flood plains that separate the hills from the Gulf of Thailand are criss-crossed by many gullies and ditches in dendritic drainage patterns. There are no large rivers or drainage basins along the southeast coast, but many small streams carry water from the uplands to the sea. The two major outlets to the sea in the Sattahip-U-Tapao area are the Klong Bang Phai which flows through the project site, and the Klong Huai Pong. The coast line is a sunken one, and the numerous offshore islands are peaks of drowned landscape.

In the airfield area are found quaternary deposits of unconsolidated silt, sand and gravel, beach and estuarine clay, and residual layers of laterite capping shale, sandstone and sandy shale containing some limestone beds.

Quarries near the base have been producing a widely-used fill material (called "jinglestone" locally) from interlayered deposits of sandstone, shale, sandy shale, and slate. This material was exclusively used for roads during construction of the airfield and showed good stability, even during wet weather. A dense gray limestone is being quarried and crushed farther north at the Navy quarry for use as asphaltic and portland cement concrete aggregate. (See Reference 1).

CLIMATIC DATA

Temperature, evaporation, and rainfall data for the Ban U-Tapao area can be found in Figures 2 and 3.

FACILITY DESIGN AND CONSTRUCTION HISTORY

All of the pavements were constructed in the years 1966 to 1968 and were designed in accordance with procedures set forth in AFM 88-6, Chapter 3, "Airfield Pavement Design, Engineering and Design, Rigid Pavement". The runway, parallel and connecting taxiways, access and hardstand taxiways, north warm-up apron, and all hardstands were designed for heavy load to support a landing gear load of 265,000 pounds, carried on twin-twin wheels spaced 37 x 62 x 37 inches, bicycle arrangement, each wheel

having a contact area of 267 square inches. All parking aprons and the south warm-up apron were designed for medium load to support a landing gear load of 100,000 pounds carried on twin wheels spaced 37-1/2 inches, tricycle arrangement, each wheel having a contact area of 267 square inches. A general summary of individual pavement facilities showing pavement type, dimensions, and approximate date of construction is shown in Table 1. It should be noted that at the recommendation of the base operations and engineering officers, and due to the important role presently played by the station, pavement facilities were not divided into primary and secondary groupings, but were all considered of equal importance. A plan view of the station with detailed dimensions is presented in Figure 4. Typical sections for most pavement facilities are shown in Figures 5 through 9. Physical characteristics of the pavement and foundation materials are given in Table 2.

CONDITION SURVEY

All methods and procedures followed during the pavement condition survey at Ban U-Tapao Airfield were dictated by EM-1110-45-753 App. III. Every pavement section at the station was visually inspected and each visible defect tallied. Defects were grouped into major and minor defects according to the following definitions:

> Major Defect - A major defect is defined as a crack or break in a concrete slab that will impair the load carrying capacity of the pavement. The defect usually extends throughout the depth of the slab; thus the individual concrete slab is subdivided by the crack into two or more parts.
>
> Minor Defect - A minor defect is defined as a crack or break in the slab that is generally confined to the surface of the concrete and does not extend throughout the depth of the slab. These defects often cause undesirable surface conditions but do not impair the structural capacity of the concrete to carry load. Minor defects may or may not develop into major defects through continued use of the pavement, but can generally be repaired by normal maintenance operations.

Predominant major defects found at Ban U-Tapao Airfield were longitudinal, transverse, and corner break cracks. Minor defects noted included joint spalls, corner spalls, embedded wood, and popouts.

In general, all but two pavement facilities were found to be in excellent condition. The exceptions were Access Taxiway 2 which was rated as poor and Apron Taxiway 2 which was rated as good, based on the frequency of occurrence of both major and minor defects and their effect on the load carrying capacity of each pavement section. The primary taxiway also contained many centerline-type longitudinal cracks which could have warranted a lower-than-excellent rating if judged solely on a defect

count basis. However, in the judgement of the evaluators, the load carrying capacity had not been reduced, thus the pavement was rated excellent. A more detailed explanation of this particular rating action is presented in the "Comments" section of this report.

A detailed narrative-type condition survey for each individual pavement facility, along with supplementary photographic coverage of typical major and minor defects can be found in Appendix A.

ALLOWABLE GROSS AIRCRAFT LOADS

Ban U-Tapao Airfield was designed for the capacity operational category, and contains pavement sections designed for Types A, B and C traffic areas.

Allowable gross aircraft loadings for each pavement facility have been developed, based on the above criteria in combination with the following design parameters:

Concrete Flexural Strength

Desired (design) concrete flexural strength for all pavements at the airfield was 700 psi (90-day strength) using a 5.75 to 6 bag concrete mix. Field curing of concrete was accomplished using a membrane curing compound. Representative concrete beams were formed, vibrated, cured in a water bath and subsequently broken to obtain the concrete flexural strength for each pavement facility. Thousands of these beams were tested. Average 90-day flexural strength for each pavement facility ranged from a low of 705 psi for Hardstand Taxiway 1 to a high of 945 psi (average of 316 beams) for Runway 18-36. These values were considered exceptionally high.

To check these figures, a limited number of cores were taken from selected pavements at the time of the evaluation. These cores were tested in tensile splitting. Such test results were related to flexural strength by the relationship:

Flexural Strength = Tensile Splitting + 200 psi

Results of tensile splitting tests yielded uniformly lower flexural strengths ranging from 580 to 700 psi for concrete areas where beam flexural strengths ranged from 705 to 890 psi. Tensile splitting values were roughly 120 psi lower than equivalent beam flexure tests.

It was felt that the lower flexural strengths obtained from the cores were more valid (1) based on the appearance of the cored concrete, and (2) based on the fact that the cores represented actual in-place concrete rather than hand-molded, separately-cured beam specimens. Thus, the flexural strengths used in the evaluation (and listed in Table 2) were obtained by subtracting 120 psi from the average of beam flexural strengths for each individual pavement facility.

Modulus of Subgrade Reaction (K)

Most of the pavement at the station is located on jinglestone fill, usually more than one meter in depth. During construction, some density tests were made on the jinglestone, but compaction control for the method-type rolling specification used was based on plate bearing tests on the fill material. Hundreds of plate bearing tests were conducted. The average of these tests was well above the maximum "K" of 500 psi allowed in design procedures.

During the evaluation, however, partial reduction of subgrade support was considered a factor in some instances of pavement distress. This could be explained by the fact that stresses imposed by plate bearing tests possibly did not penetrate much more than 1 to 2 meters into the fill. Load stresses from heavy bombers, though, may penetrate this layer and bring relatively high deep stresses to bear on the sometimes wet and weaker subgrade underlying the fill, eventually causing pavement distress. Because of this, and because allowable aircraft load calculations are based on the weakest pavement area in a facility, it was decided that a conservative "K" value of 400 pci be adopted for evaluation of all pavement facilities except the west end of Access Taxiway 2 where a 300 pci "K" value was indicated in view of the wet subgrade suspected there.

Pavement Thickness

A list of pavement thicknesses for each pavement facility can be found in Table 2. Figure 4 also provides pavement thickness data.

Traffic Areas

For most pavement areas, allowable aircraft loads have been computed using the traffic area criteria used in the design. Several facilities, however, while designed for lesser traffic, are actually receiving channelized (Type A) traffic. For these facilities, allowable aircraft loads are provided for both traffic criteria. Included in these areas are Access Taxiways 1 and 2, Hardstand Taxiways 1 and 2, and that portion of Runway 18-36 used as a through taxiway between Access Taxiway 2 and Cross Taxiway 2.

A tabulation of allowable aircraft loads is presented in Table 3. Table 4 relates the various gear configurations with present-day aircraft.

COMMENTS

In the early 1950's, the Corps of Engineers obtained data which indicated that rigid pavements constructed on high strength foundations ("K" greater than 300 pci) continued to satisfactorily carry the design traffic for long periods after the slabs had cracked. (See Reference 3). Based on these observations, the decision was reached that more than initial cracking could be tolerated in pavements constructed on high strength

foundations without causing undue aircraft or maintenance problems. Following this, a reduction was made in the design thickness of rigid pavements constructed over high "K" subgrades. Thus, some cracking is "built-into" and must be expected in pavements constructed to this criteria. Similarly, it should be assumed that, since most pavements at Ban U-Tapao contained relatively few cracks, the pavement has been and will continue to be structurally sound.

Another problem at Ban U-Tapao which is peculiar to the station but related to underlying principles of Air Force pavement design criteria is that of accelerated aircraft operations. The capacity operational category for which the field was designed is interpreted to mean unlimited operations of the design aircraft (in this case the B-52) for a period of ten years or more under normal traffic. (Reference 3). This equates to roughly 10,000 "coverages" or approximately 20,000 B-52 launches for Type A traffic areas. (Reference 3). Pavements at Ban U-Tapao are receiving traffic of many times this normal rate and can not, on this basis, be expected to last as long as normally-used pavements. That is, unless such parameters as pavement thickness, flexural strength or subgrade support exceed the design values. Under such accelerated traffic, both major and minor defects can be expected to appear earlier and to deteriorate at a faster rate.

Ban U-Tapao Airfield can not, in its entirety, be uniformly evaluated with regard to the above concepts. Individual pavement facilities critical to the mission of the station are discussed, however, in the following paragraphs:

Runway and Parallel Taxiway

The high concrete strength, equally high allowable aircraft loads, and generally excellent condition of Runway 18-36 combine to indicate an extended useful life of this facility (at least equal to the design life,) even at the present rate of accelerated traffic. The pavement is performing in an acceptable manner, except in the previously-mentioned taxiway cross-over area which, although designed to a Type C Traffic criteria (for runway interiors) was being used for Type A (channelized) traffic when it began cracking. The cracking in this area appears to have stabilized after restriction of operations over this section to unloaded aircraft. It is recommended that this restriction remain in effect, or a more serious condition could result.

It was noted that most pavement defects on the runway had not received maintenance. It is thus recommended, in light of the accelerated traffic rate, that all cracks be routed and sealed, and all spalls and similar pavement breaks be patched to prevent further deterioration of these defects into FOD problems.

On the parallel taxiway allowable aircraft loads are also higher than actual aircraft loads, and the pavement is in excellent condition except for many longitudinal cracks occurring along the crown of the center lane. This type of distress has been observed on primary taxiways

of other heavy design airfields and is not of serious concern. It can be avoided by sawing a longitudinal joint in the center lane as was done extensively at U-Tapao, even though the Air Force criteria does not call for such. These sawed or naturally-formed joints were not considered to have reduced the load-carrying capacity of the pavement, and were thus assigned to a minor category for this evaluation. This pavement facility would then be assumed to have a life expectancy roughly equivalent to that of the runway, i. e. the design life.

Maintenance on the taxiway had been performed to a greater extent than on the runway. No cracks had been repaired, however, and again it is recommended that these cracks be routed and sealed before further deterioration and subsequent FOD problems are encountered.

Access Taxiway 1

This pavement facility showed no distress at the time of the evaluation. It is an especially critical facility, though, because all loaded heavy bomber traffic from the hardstands must use this pavement in taxiing to the runway, due to the restrictions in force on the use of Access Taxiway 2. The taxiway, although designed for Type B traffic, is actually carrying a Type A traffic load. Average concrete flexural strength is also relatively low. Considering the heavy traffic intensity and lower concrete strength, it may be safe to assume that the taxiway will begin to show some signs of distress within 2 to 3 years. Whether distress occurs according to this time schedule would depend greatly on the degree of subgrade support. Located as it is near the foot of a small hill, higher subgrade support may be expected than is evidenced by Access Taxiway 2 which was located in the area of an old klong (stream).

Access Taxiway 2

This taxiway (between Runway 18-36 and Hardstand Taxiway 1) rated as poor, and contained many cracks, most of which could be identified as load cracks. Average concrete flexural strength for this pavement was among the lowest found at the station. During previous investigations, as well as during this evaluation, reasons for the pavement distress on this taxiway were suspected to be a combination of (1) Type B traffic design, i.e. pavement thinner than it would have been for Type A traffic design, (2) lower concrete strength, and (3) some settlement or loss of subgrade support, probably due to wet conditions in the subgrade. It is thus recommended that aircraft operations on this area continue to be restricted to unloaded aircraft.

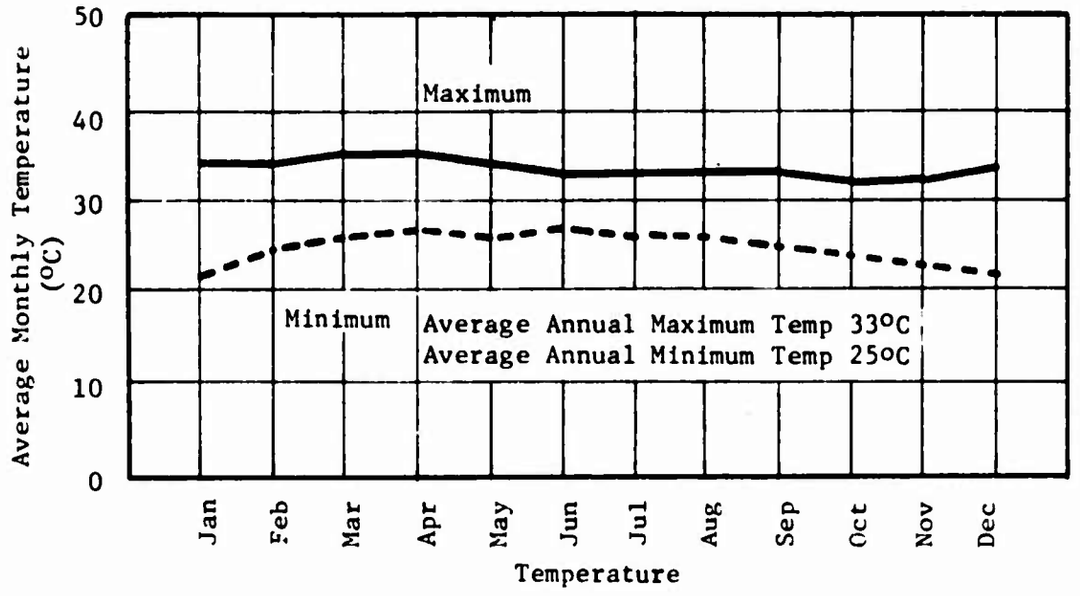
Hardstand Taxiway 1

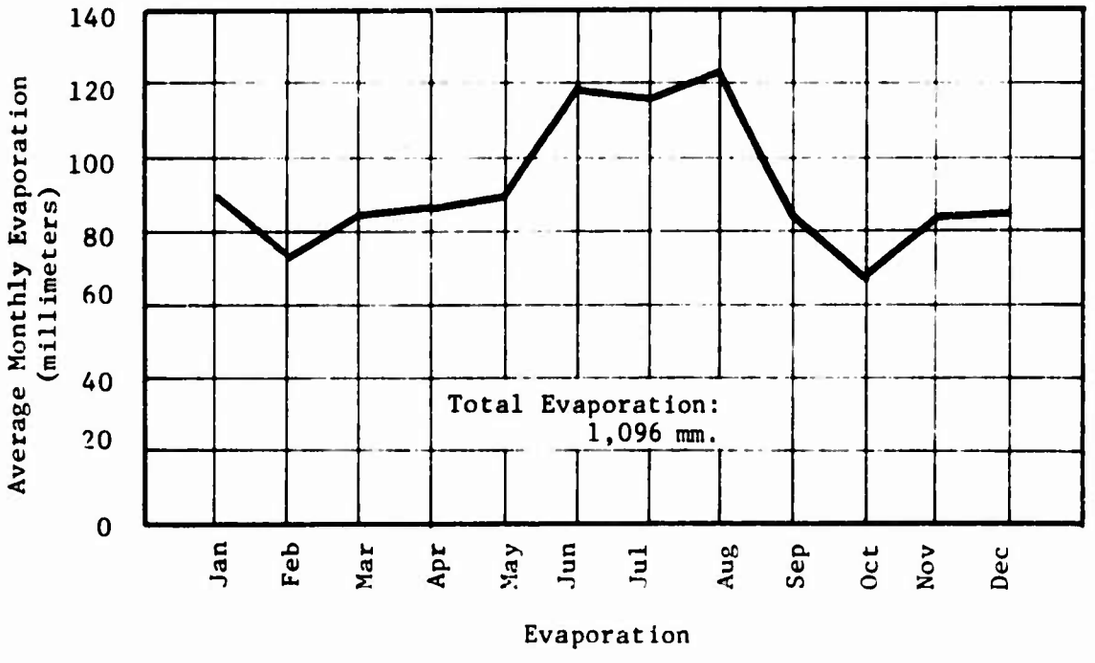
Approximately the first 500 feet of this taxiway (adjacent to Access Taxiway 2) showed signs of distress soon after construction and was replaced.(See Figure 4). The replaced section exhibits very high concrete

flexural strength and has an additional meter of underlying jinglestone fill. No further distress is expected in this area.

The remainder of the taxiway, however, contains poorer concrete (lowest average flexural strength on the station); lesser subgrade support, particularly on the south half; and receives Type A traffic on a pavement thickness designed for Type B traffic. In these respects, the prognosis for this pavement section is similar to that for Access Taxiway 1 - this is, additional cracking can be expected within a few years if operations continue at present or higher rates.

It should be noted that all predictions of possible future performance presented in this report are not firm predictions, but are based only on the best available evidence in combination with current procedures for predicting pavement life (which are, at best, only approximations). Further, as has been previously explained, the appearance of some cracking is to be expected in any pavement designed to this criteria. Such cracking, if and when it occurs, should not be construed to indicate a loss of load carrying capacity unless there is definite evidence to the contrary.

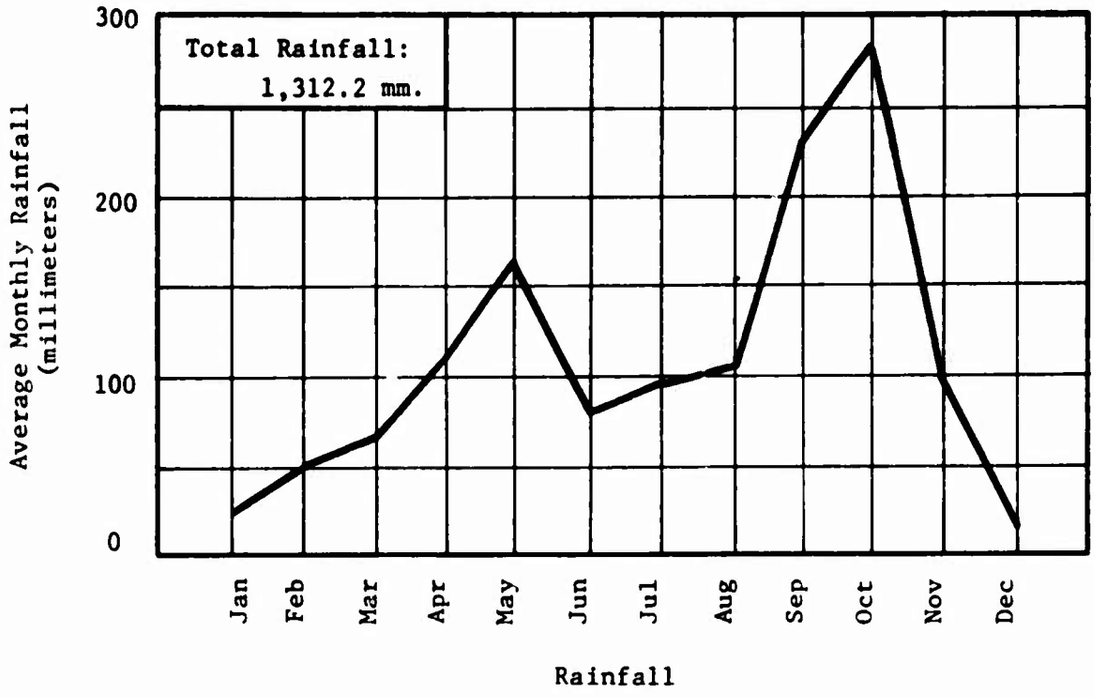


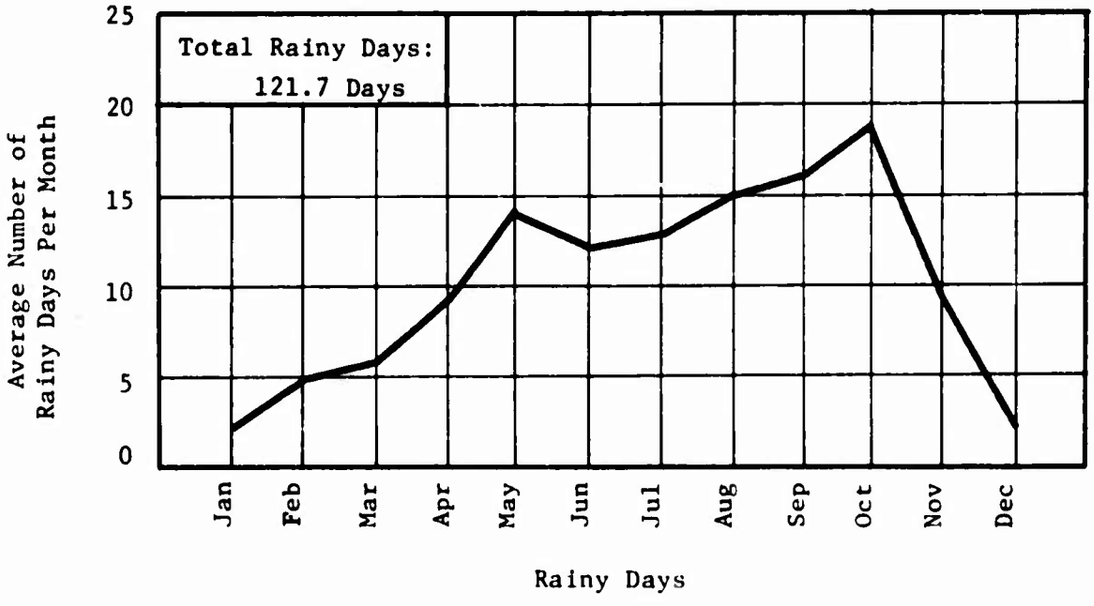


From: Royal Thai Naval Air Station--Ban U-Tapao Soils and Foundation Report, NBy 73038, Louis Berger-Von Storch and Burkavage

Source: Meteorological department, Bangkok.

Figure 2. Temperature and Evaporation Data for Ban U-Tapao Airfield.



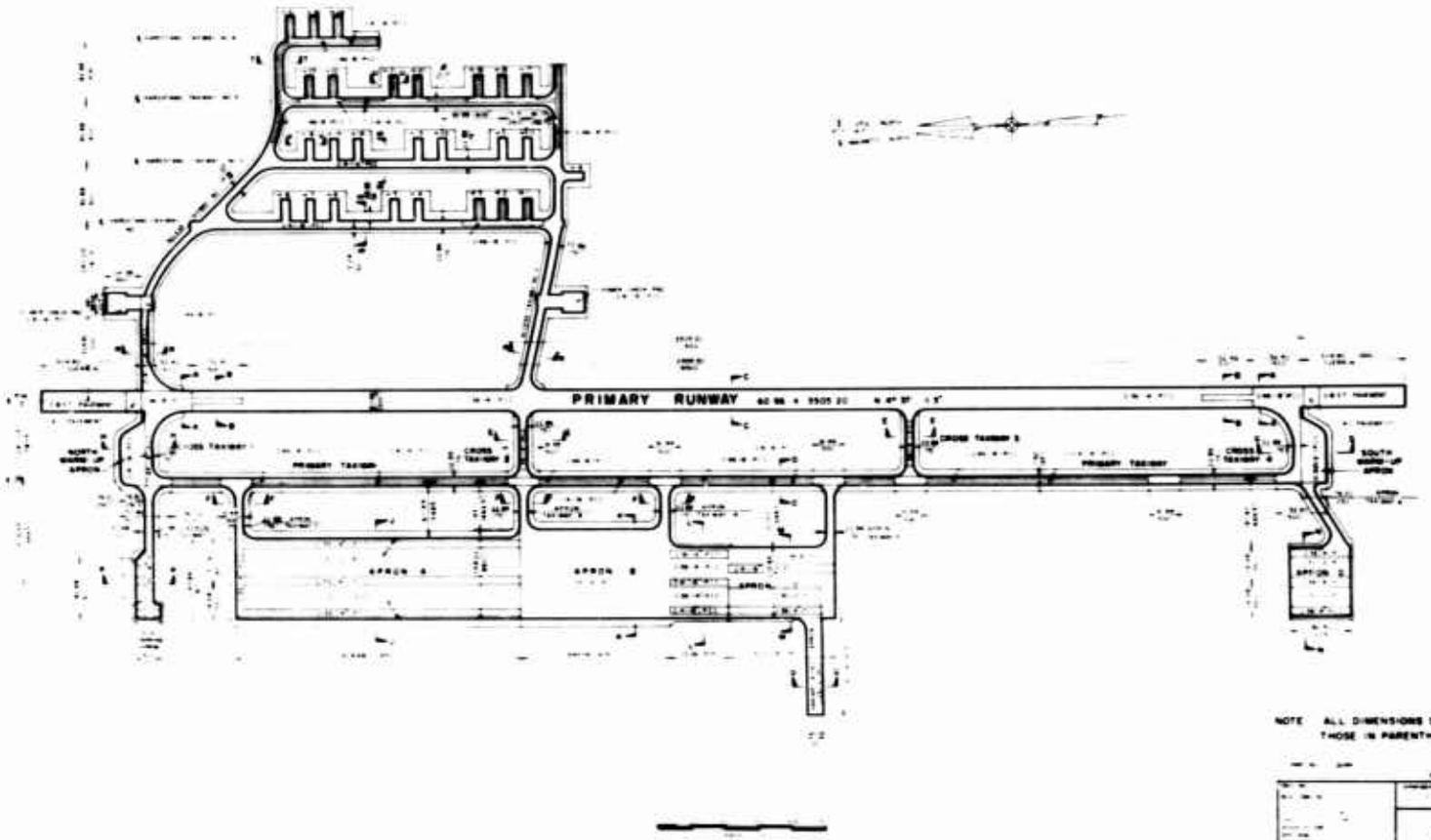


From: Royal Thai Naval Air Station--Ban U-Tapao Soils and Foundation Report, NBy 73038, Louis Berger-Von Storch and Burkavage

Note: Data from 30-year record (1931-1960)

Source: Meteorological department, Bangkok.

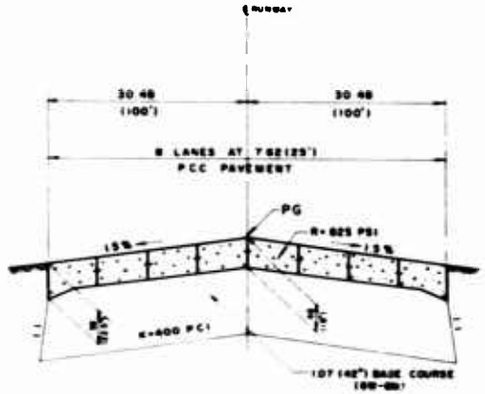
Figure 3. Rainfall and Rainy Day Data for Ban U-Tapao Airfield



NOTE ALL DIMENSIONS SHOWN ARE IN METERS
THOSE IN PARENTHESIS ARE FEET OR INCHES

ROYAL THAI NAVY
BAN U-TAPAO AIRFIELD
DETAILED PLAN VIEW

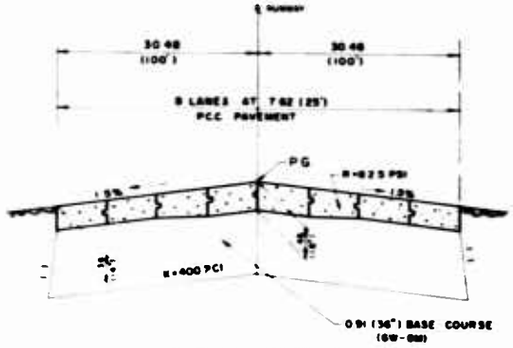
FIGURE 4



SECTION A-A

RUNWAY (END 500 FT)

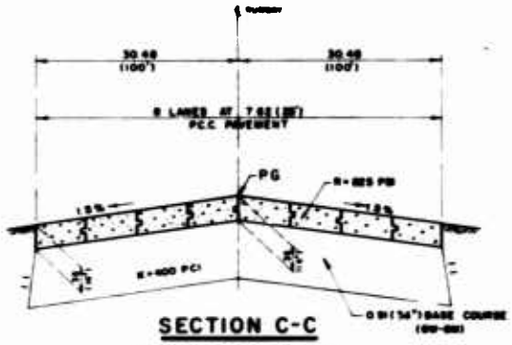
SCALE HORIZONTAL 1:1000
VERTICAL 1:100



SECTION B-B

RUNWAY (1ST 500 FT)

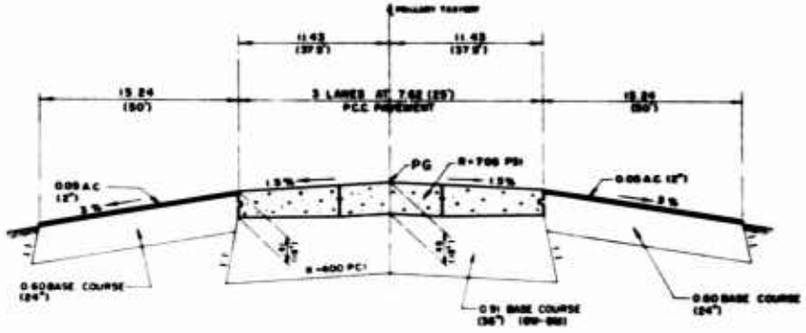
SCALE HORIZONTAL 1:1000
VERTICAL 1:100



SECTION C-C

RUNWAY (INTERIOR) RIGID PAVT

SCALE HORIZONTAL 1:1000
VERTICAL 1:100



SECTION D-D

PRIMARY TAXIWAY

SCALE HORIZONTAL 1:500
VERTICAL 1:100

ROYAL THAI NAVY
SAN U-TAPAO AIRFIELD
PAVEMENT CROSS-SECTIONS

F 04001

FIGURE 5

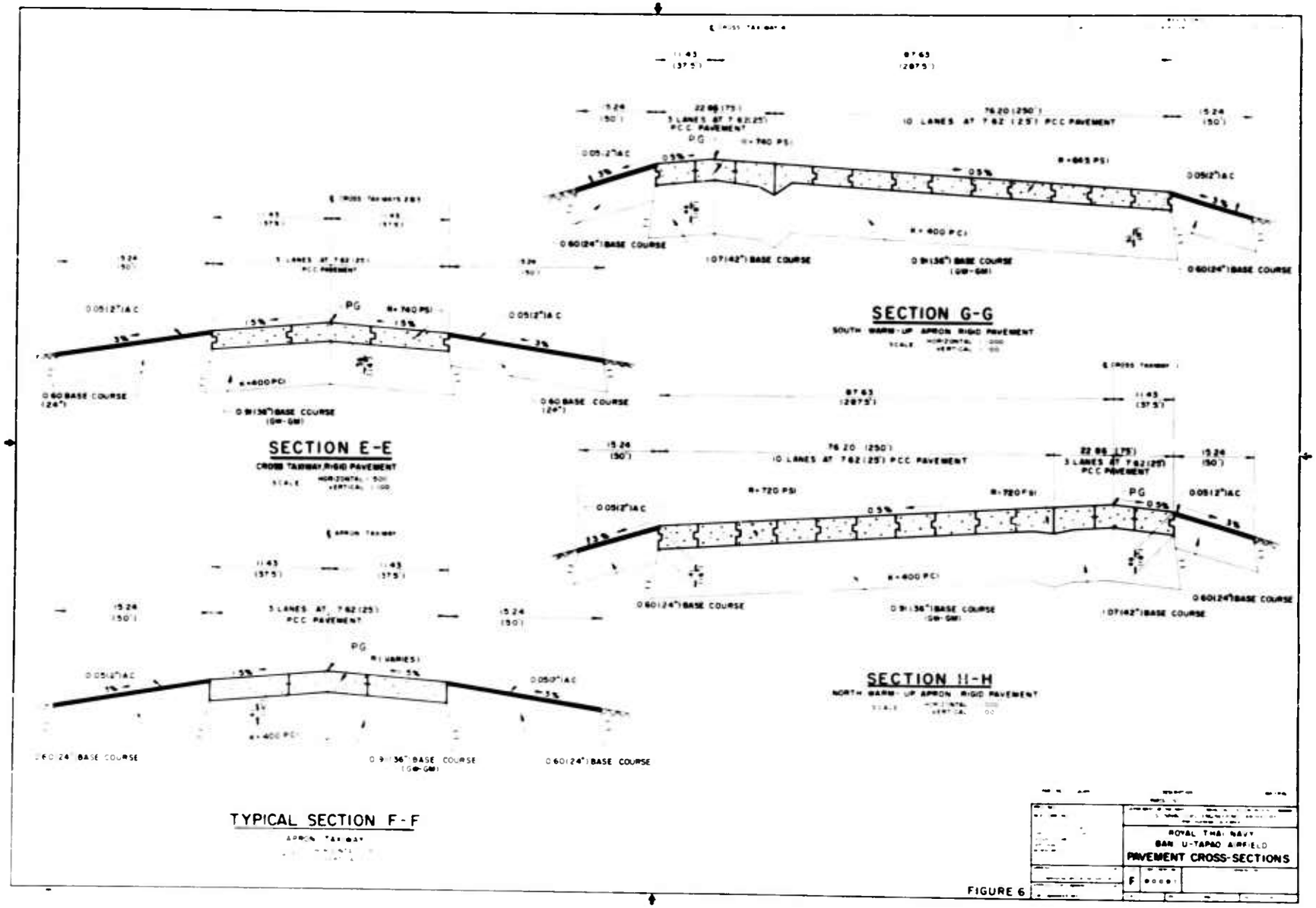

SECTION G-G
SECTION E-E
SECTION H-H
TYPICAL SECTION F-F
ROYAL THAI NAVY
SAN U-TAPAO AIRFIELD
PAVEMENT CROSS-SECTIONS

FIGURE 6

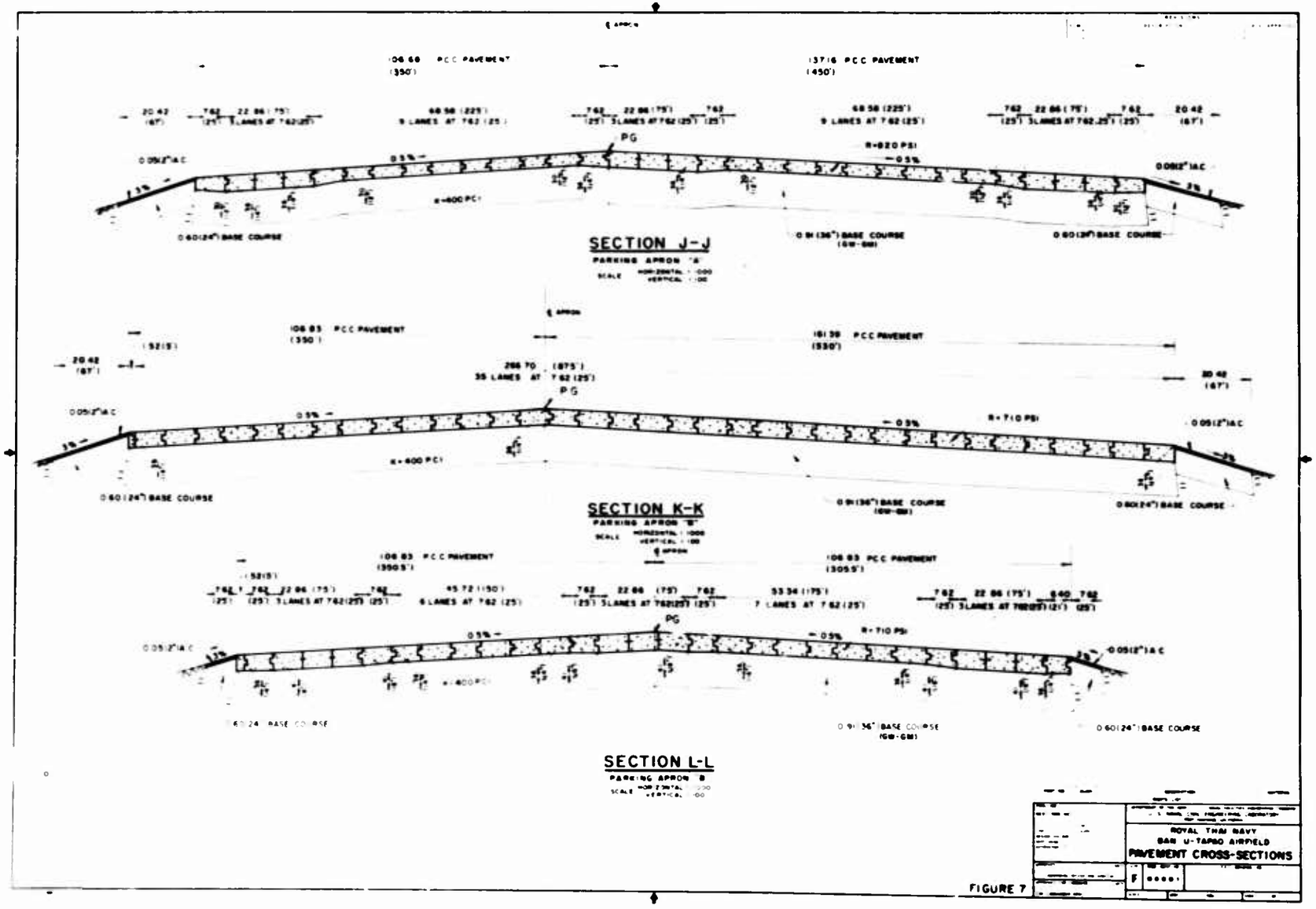
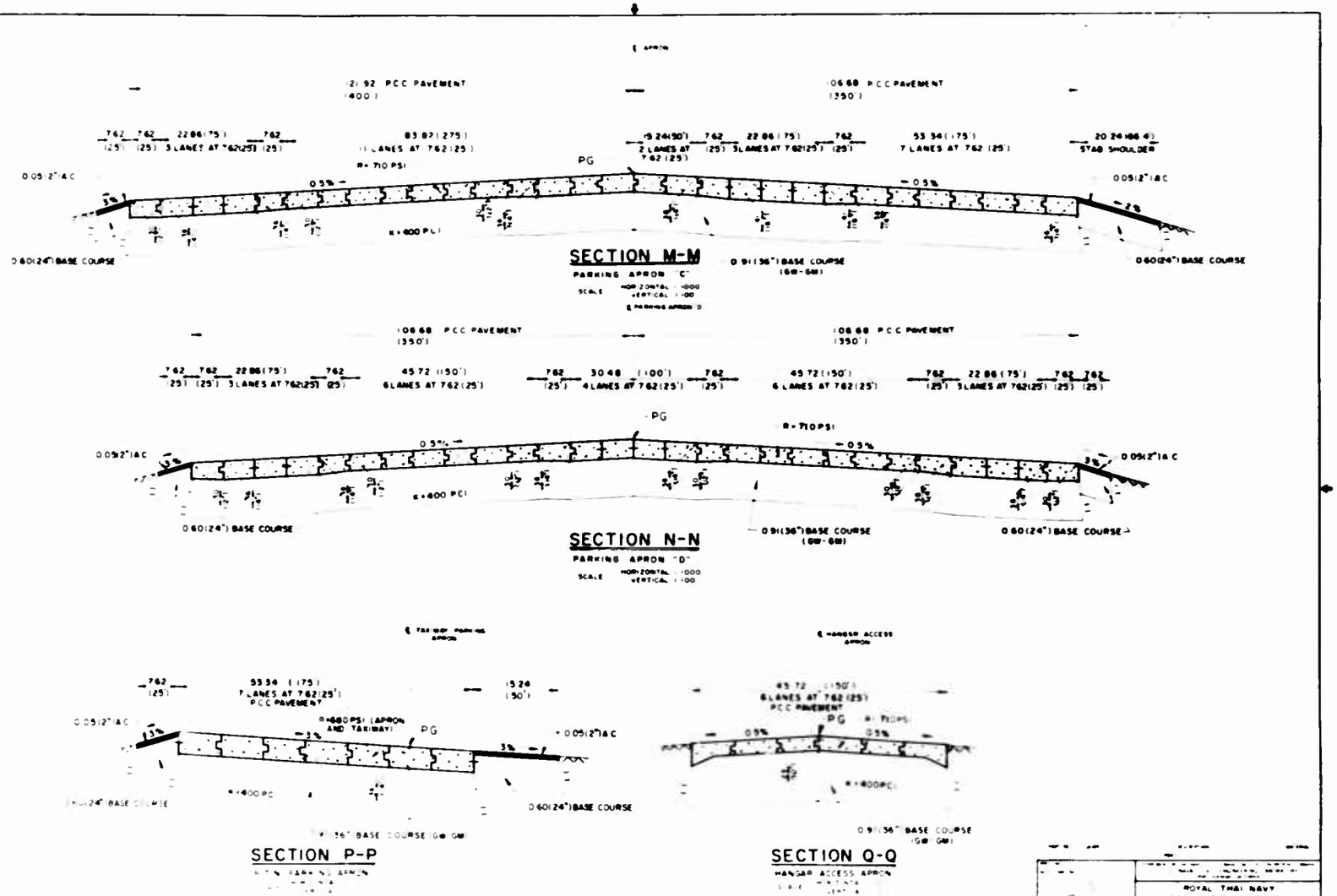

SECTION J-J
PARKING APRON 'A'
SECTION K-K
PARKING APRON 'B'
SECTION L-L
PARKING APRON 'B'
PG
PCC PAVEMENT
BASE COURSE
ROYAL THAI NAVY
SAN U-TAPAO AIRFIELD
PAVEMENT CROSS-SECTIONS

FIGURE 7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PARKING APRON "C"
SECTION N-N
PARKING APRON "D"
SECTION P-P
SECTION Q-Q
HANGAR ACCESS APRON
ROYAL THAI NAVY
U-TAPAO AIRFIELD
PAVEMENT CROSS-SECTIONS

FIGURE 8

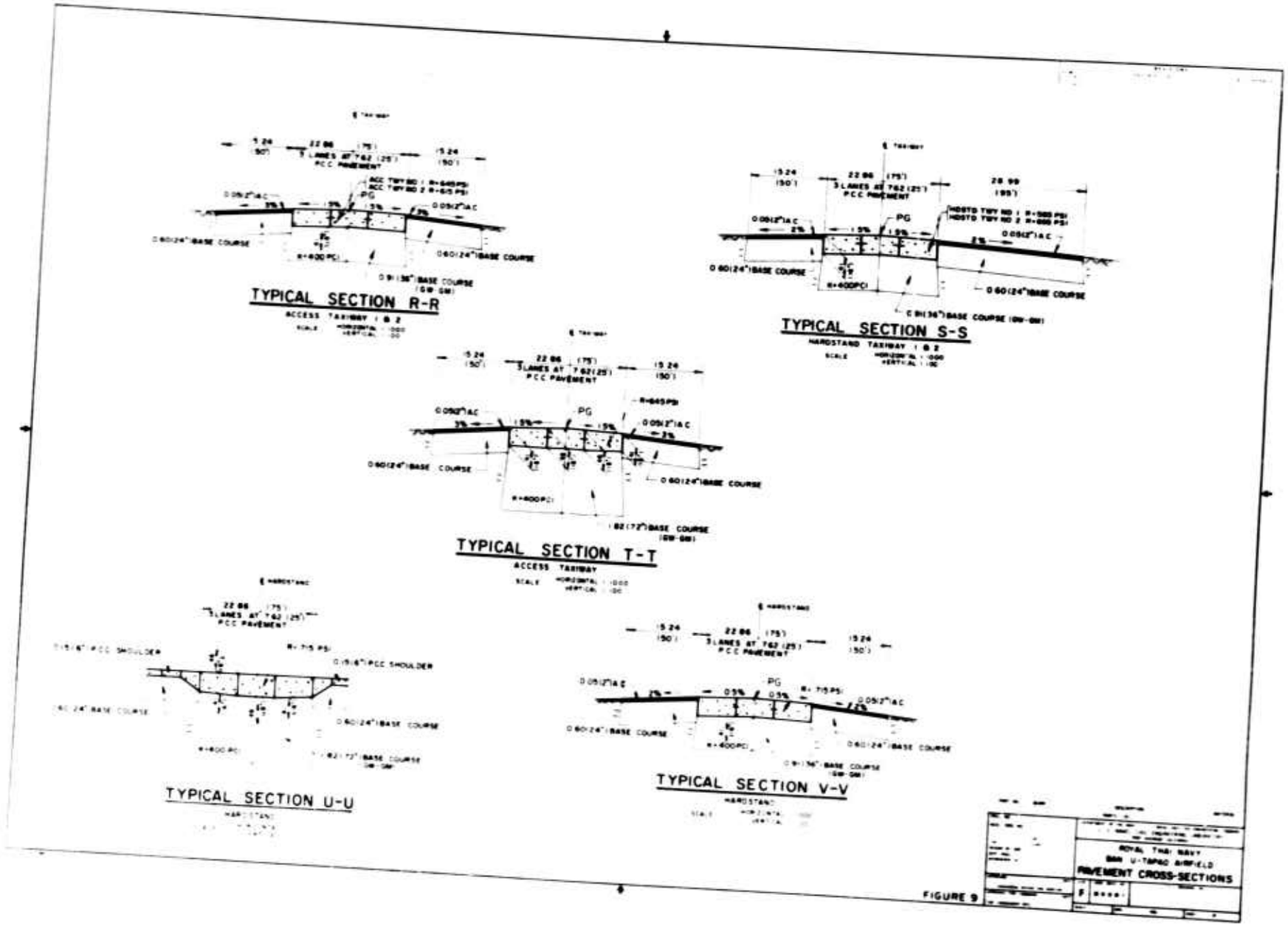
TYPICAL SECTION R-R
ACCESS TAXIWAY 1 & 2
TYPICAL SECTION S-S
HARDSTAND TAXIWAY 1 & 2
TYPICAL SECTION T-T
ACCESS TAXIWAY
TYPICAL SECTION U-U
TYPICAL SECTION V-V
HARDSTAND
ROYAL THAI NAVY
U-TAPAO AIRFIELD
PAVEMENT CROSS-SECTIONS

FIGURE 9

TABLE 1 SUMMARY AND CONSTRUCTION HISTORY OF PAVEMENT FACILITIES

Pavement Facility	Type	Dimensions			Date Constructed
		Thickness in. (cm.)	Length ft. (meters)	Width ft. (meters)	
Runway 18-36	PCC	14"(36)to 18"(46)	11,500 (3200.40)	200 (182.88)	1966 - 67
Primary Taxiway	PCC	16"(41)to 18"(46)	10,950 (3337.50)	75 (22.86)	1966 - 67
Access Taxiway #1	PCC	16"(41)to 18"(46)	3,920 (1195.00)	75 (22.86)	1966 - 68
Access Taxiway #2	PCC	16"(41)to 18"(46)	2,700 (827.00)	75 (22.86)	1966 - 68
Hardstand Taxiway #1	PCC	16"(41)to 18"(46)	3,650 (1113.25)	75 (22.86)	1966 - 68
Hardstand Taxiway #2	PCC	16(41)	2,665 (820)	75 (22.86)	1966 - 68
Hardstand Taxiway #3	PCC	16"(41)to 18"(46)	2,567 (790)	75 (22.86)	1966 - 68
Hardstand Taxiway #4	PCC	16"(41)to 18"(46)	650 (200)	75 (22.86)	1966 - 68
Cross Taxiway #1 & 4	PCC	18"(46)	650 (200)	75 (22.86)	1966 - 67
Cross Taxiway #2 & 3	PCC	14"(36)	650 (200)	75 (22.86)	1966 - 67
Apron Taxiway #1, 2, 3, 4 & 6	PCC	14"(36)	650 (200.0)	75 (22.86)	1966 - 67
Apron Taxiway #5	PCC	16"(41)	612.5 (186.54)	75 (22.86)	1966 - 67
Parking Apron A	PCC	12"(30)to 14"(36)	2,850 (868.68)	800 (243.84)	1966 - 67
Parking Apron B	PCC	14"(36)	1475(449.58)	880(268.22)	1966 - 67
	PCC	14"(36)	575(175.26)	700(213.66)	1966 - 67
Parking Apron C	PCC	12"(30),14"(36) & 16"(41)	1,050 (320.04)	700 (213.66)	1966 - 68
Parking Apron D	PCC	14"(36)	625 (190.50)	700 (213.66)	1966 - 67

TABLE 1 (Cont'd) SUMMARY AND CONSTRUCTION HISTORY OF PAVEMENT FACILITIES

Pavement Facility	Type	Dimensions			Date Constructed
		Thickness in. (cm.)	Length ft. (meters)	Width ft. (meters)	
Royal Thai Navy Apron	PCC	12"(30)to 14"(36)	600 (182.88)	175 (53.54)	
Hanger Access Apron	PCC	12"(30)	975 (297.18)	150 (45.72)	1966 - 67
North Warm-up Apron	PCC	16"(41)	Area = 15,480 Sq. Yds. (12,943 Sq. M.)		1966 - 67
South Warm-up Apron	PCC	12"(30)	Area = 15,719 Sq. Yds. (13,143 Sq. M.)		1966 - 67
Hardstands	PCC	16"(41)to 18"(46)	225 (68.58)	75 (22.86)	
North & South Power Check Pads	PCC	16"(41)	475 (144.9)	225 (68.58)	1967 - 68

Table 2. Summary of Physical Property Data

Facility No. and Identification	Pavement			Base			Subgrade	General Condition of Area
	Thickness in (CM)	Description	Flex. Str. psi	Thickness in (CM)	Description	K pci	Classification	
Runway 18-36 1st 500 ft. ends	18 (46)	P.C.C.	825	42 (107)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Runway 18-36 2nd 500 ft. ends	18 (46) 14 (36)	P.C.C. (Center 50') P.C.C. (Outer Lanes)	825	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Runway 18-36 Interior	14 (36)	P.C.C.	825	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Primary Taxiway	18 (46) 16 (41)	P.C.C. (Center 25') P.C.C. (Outer Lanes)	705	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Access Taxiway 1	18 (46) 16 (41)	P.C.C. (Center 25' East 700') P.C.C. (Rest of Taxiway)	645	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Access Taxiway 2	18 (46) 16 (41)	P.C.C. (Center 25' East 275') P.C.C. (Rest of Taxiway)	615	36 (91)	Jinglestone* GW-GM	300	Brown Silty Sand (SM)	First 1500'-poor Next 1200' Excellent
Hardstand Taxiway 1	18 (46) 16 (41)	P.C.C. (Center 25' 750' long) P.C.C. (Rest of Taxiway)	580	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent

* Jinglestone was quarried from interlayered deposits of sandstone, shale, sandy shale and slate.

Table 2. Summary of Physical Property Data (cont'd)

Facility No. and Identification	Pavement			Base			Subgrade	General Condition of Area
	Thickness in (CM)	Description	Flex. Str. psi	Thickness in (CM)	Description	K pci	Classification	
Hardstand Taxiway 2	16 (41)	P.C.C.	695	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Hardstand Taxiway 3	18 (46) 16 (41)	P.C.C. (Center 25') P.C.C. (Outer Lanes)	700	72 (180)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Hardstand Taxiway 4	18 (46) 16 (41)	P.C.C. (Center 25') P.C.C. (Outer Lanes)	770	72 (180)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Cross Taxiway 1	18 (46)	P.C.C.	770	42 (107)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Cross Taxiway 2	14 (36)	P.C.C.	740	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Cross Taxiway 3	14 (36)	P.C.C.	740	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Cross Taxiway 4	18 (46)	P.C.C.	740	42 (107)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Apron Taxiway 1	14 (36)	P.C.C.	680	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Apron Taxiway 2	14 (36)	P.C.C.	820	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent

* Jinglestone was quarried from interlayered deposits of sandstone, shale, sandy shale and slate.

Table 2. Summary of Physical Property Data (cont'd)

Facility No. and Identification	Pavement			Base			Subgrade	General Condition of Area
	Thickness in (CM)	Description	Flex. Str. psi	Thickness in (CM)	Description	K pci	Classification	
Apron Taxiway 3	14 (36)	P.C.C.	740	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Apron Taxiway 4	14 (36)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Apron Taxiway 5	16 (41)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Apron Taxiway 6	14 (36)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Parking Apron A	14 (36) 12 (30)	P.C.C.	820	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Parking Apron B	14 (36)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Parking Apron C	16 (41) 12 (30) 14 (36)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Parking Apron D	14 (36) 12 (30)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Royal Thai Navy Apron	14 (36) 12 (30)	P.C.C.	680	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent

* Jinglestone was quarried from interlayered deposits of sandstone, shale, sandy shale and slate.

Table 2. Summary of Physical Property Data (cont'd)

Facility No. and Identification	Pavement			Base			Subgrade	General Condition of Area
	Thickness in (CM)	Description	Flex. Str. psi	Thickness in (CM)	Description	K pci	Classification	
Hanger Access Apron	12 (30)	P.C.C.	710	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
North Warm-up Apron	16 (41)	P.C.C.	720	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
South Warm-up Apron	12 (30)	P.C.C.	645	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Hardstands 1,2,3, 17-23,29,30, &31	18 (46) 16 (41)	P.C.C. (Center 25') P.C.C. (Outer Lanes)	725	72 (180)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Hardstands 4-8	16 (41)	P.C.C.	625	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
Hardstands 9-16	16 (41)	P.C.C.	720	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent
South and North Power Check	16 (41)	P.C.C.	645	36 (91)	Jinglestone* GW-GM	400	Brown Silty Sand (SM)	Excellent

* Jinglestone was quarried from interlayered deposits of sandstone, shale, sandy shale and slate.

TABLE [illegible]

SUMMARY OF ALLOWABLE GROSS AIRCRAFT LOADINGS

Date of Evaluation [illegible]

[illegible] Airfield [illegible] Tapao, Thailand

Main Landing Gear Types and Configurations

Facility No. and Identification	Pavement Operational Use	Single Wheel Tricycle: [illegible] psi Tire Pressure	Single Wheel Tricycle: 100 Sq. In. Contact Area Each Tire	TW 24" C-C 225 Sq. In. Contact Area Each Tire	Single Tandem Wheels [illegible] C-C 400 Sq. In. Contact Area Each Tire	Multiple Wheel Tricycle Gear: TW 37" C-C 267 Sq. In. Contact Area Each Tire	Multiple Wheel Tricycle Gear: TW 44" C-C 430 Sq. In. Contact Area Each Tire	Twin Tandem [illegible] 267 Sq. In. Contact Area Each Tire	Dual TW Tandem [illegible] Sq. In. Contact Area Each Tire	Twin [illegible] Sq. In. Contact Area Each Tire	[illegible] Sq. In. Contact Area Each Tire	Traffic Area: [illegible]	Traffic Area: [illegible]
Runway [illegible]													
[illegible] Ends	Capacity	[illegible]	240,[illegible]	420,000	[illegible]	400,[illegible]	[illegible]	[illegible]	500,000	[illegible]	[illegible]	[illegible]	A
Interior	Capacity	[illegible]	[illegible]	285,000	380,000	[illegible]	[illegible]	[illegible]	350,000	[illegible]	[illegible]	[illegible]	A
Interior	Capacity	[illegible]	180,000	330,000	520,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C	C
Primary Taxiway	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	450,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
Access Taxiway [illegible]	Capacity	[illegible]	[illegible]	275,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B	A
Access Taxiway [illegible]	Capacity	[illegible]	[illegible]	275,000	420,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B	B
Access Taxiway [illegible]	Capacity	[illegible]	[illegible]	230,000	[illegible]	[illegible]	[illegible]	[illegible]	275,000	[illegible]	[illegible]	B	A
Access Taxiway [illegible]	Capacity	[illegible]	[illegible]	230,000	[illegible]	[illegible]	340,000	[illegible]	320,000	[illegible]	[illegible]	B	B
Hardstand Taxiway [illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	320,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
Hardstand Taxiway [illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	370,000	[illegible]	350,000	[illegible]	[illegible]	[illegible]	B
Hardstand Taxiway [illegible]	Capacity	[illegible]	[illegible]	300,000	340,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
Hardstand Taxiway [illegible]	Capacity	[illegible]	[illegible]	300,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
Hardstand Taxiway [illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	350,000	450,000	[illegible]	430,000	[illegible]	[illegible]	[illegible]	A
Hardstand Taxiway [illegible]	Capacity	[illegible]	[illegible]	340,000	310,000	370,000	460,000	370,000	460,000	275,000	[illegible]	B	A
Cross Taxiway [illegible]	Capacity	[illegible]	[illegible]	390,000	510,000	370,000	440,000	[illegible]	[illegible]	[illegible]	[illegible]	B	A
Cross Taxiways [illegible]	Capacity	[illegible]	[illegible]	330,000	430,000	310,000	430,000	[illegible]	490,000	245,000	[illegible]	B	A
Cross Taxiway [illegible]	Capacity	[illegible]	245,000	380,000	440,000	310,000	470,000	350,000	450,000	265,000	[illegible]	[illegible]	A
Apron Taxiway [illegible]	Capacity	[illegible]	110,000	240,000	310,000	230,000	410,000	300,000	[illegible]	[illegible]	[illegible]	B	A
Apron Taxiway 2	Capacity	[illegible]	[illegible]	245,000	380,000	275,000	370,000	400,000	[illegible]	[illegible]	[illegible]	B	A
Apron Taxiways [illegible]	Capacity	[illegible]	[illegible]	[illegible]	340,000	245,000	330,000	[illegible]	[illegible]	[illegible]	[illegible]	B	A
Apron Taxiway [illegible]	Capacity	[illegible]	[illegible]	[illegible]	400,000	245,000	390,000	330,000	[illegible]	225,000	[illegible]	B	A
Apron Taxiway [illegible]	Capacity	[illegible]	[illegible]	[illegible]	340,000	245,000	330,000	330,000	310,000	[illegible]	360,000	B	A
Parking Apron A	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	290,000	390,000	270,000	[illegible]	[illegible]	[illegible]	B	B
Parking Apron [illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	245,000	330,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
Parking Apron [illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	245,000	330,000	[illegible]	[illegible]	[illegible]	[illegible]	B	B
	Capacity	[illegible]	[illegible]	[illegible]	310,000	[illegible]	310,000	[illegible]	245,000	[illegible]	[illegible]	B	B
Parking Apron [illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	225,000	310,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
[illegible]	Capacity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 4

AIRCRAFT IDENTIFICATION INDEX

Single Wheel		Multiple Wheel						
Tricycle		Tricycle						Bicycle
100 PSI TIRE PRESSURE	100 SQ. IN. CONTACT AREA EACH TIRE	TW 28" C-C 226 SQ. IN. CONTACT AREA EACH TIRE	SINGLE TANDEM 60" C-C 400 SQ. IN. CONTACT AREA EACH TIRE	TW 37" C-C 267 SQ. IN. CONTACT AREA EACH TIRE	TW 44" C-C 630 SQ. IN. CONTACT AREA EACH TIRE	TWIN TANDEM 33" x 48" 202 SQ. IN. CONTACT AREA EACH TIRE	C-5A GEAR CONFIGURATION	TWIN-TWIN 37" -62" -37" 267 SQ. IN. CONTACT AREA EACH TIRE
1	2	3	4	5	6	7	8	9
B-66	F-84	C-119	C-130	B-50	C-124	C-133	C-5A	B-52
C-45	F-86	C-54		KC-97		C-135		
C-47	F-89	C-118		C-97		KC-135		
C-46	F-94	C-131		C-121		C-141		
C-123	F-100	T-29				VC-137		
	F-101							
	B-57							
	F-102							
	F-104							
	F-105							
	F-106							
	F-111							
	F-4C							
	T-38							

APPENDIX A

CONDITION SURVEY NARRATIVE AND PHOTOGRAPHS

PAVEMENT CONDITION SURVEY

RUNWAY 18-36

General Condition - Excellent

Eighty five of 3,680 total slabs (2.3 percent) were found to have major defects, mostly unsealed longitudinal or transverse cracks or corner breaks. Most of these cracked slabs occurred in the lanes immediately to the left and right of the centerline (the travelled lanes) in which 7.5 percent of all slabs were cracked.

The cracked slabs appeared to follow a random pattern, except for two localized areas where more severe cracking (in terms of number of slabs) was evident. The most severe of these areas occurred at the intersection of the runway with Access Taxiway 2 and Cross Taxiway 2. At this spot, the three rows of runway slabs corresponding to the width of the taxiways on either side contained 11 cracked slabs out of a total of 24 (46 percent). (See Figures A-1, A-2 and A-3). Rated by itself, this small area could only be rated as poor. Designed as a runway interior, (Type C traffic), the area is being used as a taxiway (channelized traffic, type A) by heavy bombers entering and leaving the hardstand area by way of Access Taxiway 2.

The second pavement area where localized distress has occurred is in the region of Station 55 + 250, about 900 feet from the south end of the runway. (See Figures A-4 and A-5). At this location, cracks have occurred in a group of 12 slabs, with some cracks occurring in lanes outside the center two. No evidence of lower-strength concrete could be found in this area. Contour maps, however, indicate that the site lies within a few feet of the course of an old klong (stream) over which 3 to 4 meters of fill was necessary during construction. It is thus possible that slight settlement and subsequent partial loss of subgrade support has occurred at this point. A majority of all cracks were unrepaired, unsealed, and showed evidence of incipient spalling.

Minor slab defects were of varying types, but included small joint spalls, patches, popouts, embedded wood, and crazed slab surfaces. Approximately 15 percent of all slabs contained one or more of these minor defects. Joint spalls were usually very small, but some showed evidence of loosened particles and approximately 2 - 5 percent of these could be rated as severe. At least two corner spalls were observed from which loose material had disappeared, leaving sharp edges and potential tire problems. Except for a live 50-cal. cartridge and a small wrench, no loose material was observed on the runway.

Patches were constructed of either hot mix asphaltic concrete (AC) or epoxy concrete and were generally in good condition. Popouts and embedded wood were observed but were small and of little significance.

Approximately 15 percent of all slabs were observed with hairline crazing or surface shrinkage cracks. These cracks were surficial only and although detracting from appearance, did not represent pavement distress.

RUNWAY 18-36 Cont'd.

Joint seals were in excellent condition, with only very infrequent occurrences of bubbled seals. Overruns (DBST) were also in excellent condition.

TAXIWAY

General Condition - Excellent

One hundred eighteen of 1,274 total slabs (9.3 percent of all slabs) contained defects which must be classified as "major", according to the foregoing Corps of Engineers criteria. However, 100 of these defects were longitudinal cracks directly down the centerline of the center slabs. This is a common occurrence on channelized primary taxiways at heavy load airfields and occurred here soon after initial traffic began. When the cracking became apparent, a centerline joint was sawed in all remaining uncracked slabs (about 75 percent of all center slabs). This, in effect, stabilized further occurrences of uncontrolled cracking. These centerline longitudinal cracks act essentially as joints where none were placed and as such present no structural deficiency. (See Figure A-6).

One group of seven adjoining slabs in the center lane were found to have severe surface map cracking indicative of poor concrete. (See Figure A-7).

Minor defects noted were usually small joint spalls, embedded wood, and small patches. Such minor defects occurred in approximately 14 percent of all slabs, and were generally insignificant. Patching of minor defects had been extensively performed, with patching of over one square foot in area noted in 140 slabs (11 percent). Patches were made of AC or epoxy concrete and, except for a few instances of minor cracking or spalling at the edge of a patch, had maintained their integrity under traffic. (See Figure A-8).

Joint seals and asphaltic concrete shoulders were in excellent condition.

ACCESS TAXIWAY 1

General Condition - Excellent

This taxiway contained no major defects. About 5 percent of slabs contained minor defects such as small spalls, popouts, or embedded wood. Asphalt shoulders were in excellent condition. Joint seals were in excellent condition, with a few embedded small aggregates.

PAVEMENT CONDITION SURVEY

ACCESS TAXIWAY 2

(West Half)
General Condition - Poor

Twenty five of 60 center lane slabs (41.6 percent) contained major pavement defects. Most of these defects were transverse cracks with the appearance of having occurred under load. Seven other cracked slabs were observed in outer lanes. Some of these appeared to be shrinkage cracks. Slight dishing or settlement of at least two center lane slabs was noted, with standing water very evident on one of these. (See Figures A-11 through A-14). All cracks but one were sealed. Minor defects occurred in only 3.5 percent of all slabs. Joint seals were in excellent condition, as were the asphalt shoulders.

ACCESS TAXIWAY 2

(East Half)

General Condition - Excellent

No major defects were found in this section of the taxiway. About 3 percent of all slabs contained minor defects. Joint seals and asphalt shoulders were in excellent condition.

HARDSTAND TAXIWAY 1

General Condition - Excellent

Approximately 500 feet of the south end of this taxiway was rebuilt after pavement distress (severe cracking) occurred shortly after the pavement was subjected to traffic. This area was in near perfect condition. In the remainder of the taxiway, nineteen slabs contained major defects (4.4 percent of all slabs), usually transverse cracks. (See Figure A-15). More than half of these were unsealed. Centerline joints by sawing had been made in all center lane slabs. An additional 64 slabs contained minor defects, mostly small joint spalls, popouts, and embedded wood. Joint seals were in excellent condition, with only an infrequent case of bubbled joints. Asphalt and concrete shoulders were in excellent condition.

HARDSTAND TAXIWAY 2

General Condition - Excellent

Three of 342 slabs (less than 1 percent) contained major defects (unsealed transverse cracks). An additional 48 slabs (14 percent) contained minor defects, mostly very small joint spalls, popouts, and embedded wood. Joint seal contained considerable small aggregate, but was in excellent condition. Shoulders were in excellent condition.

PAVEMENT CONDITION SURVEY

HARDSTAND TAXIWAY 3

General Condition - Excellent

No major defects were observed in 315 total slabs. Twenty eight slabs (9 percent) contained minor defects, mostly embedded wood and pop-outs. Joint seal contained some small aggregate, and bubbled infrequently along sawed centerline joint. (See Figure A-16). Condition of joint seal was excellent. Shoulders were in excellent condition.

HARDSTAND TAXIWAY 4

General Condition - Excellent

This taxiway is under construction, with only 99 slabs complete. It has not experienced aircraft traffic and shows no major and no minor defects. (See Figure A-17 and A-18).

CROSS TAXIWAY 1

General Condition - Excellent

No major defects were noted. Seven slabs (9 percent) exhibited patches (AC or epoxy concrete) in excess of one square foot in area. Patches were in very good condition. An additional five slabs had minor unrepaired joint spalls or embedded wood. Joint seals and asphaltic concrete shoulders were in excellent condition.

CROSS TAXIWAY 2

General Condition - Excellent

No major defects were found. Four slabs (5 percent) showed patching (AC or epoxy concrete). Patches were in very good condition. An insignificant number of minor defects were noted. Joint seals and asphaltic concrete shoulders were in excellent condition, with only a very slight occurrence of bubbling joint seal.

CROSS TAXIWAY 3

General Condition - Excellent

No major and no minor defects were found. Joint seals and shoulders were in excellent condition.

PAVEMENT CONDITION SURVEY

CROSS TAXIWAY 4

General Condition - Excellent

Three of 78 slabs, all in the center lane, were found to be cracked, one into five pieces. Two other slabs had patching which appeared in very good condition. Minor defects (popouts and embedded wood) were found in five other slabs (6 percent). Joint seals and asphalt shoulders were in excellent condition.

APRON TAXIWAY 1

General Condition - Excellent

No major defects were found. Less than one percent minor defects, mostly embedded wood and popouts, were noted. Joint seals and shoulders were in excellent condition.

APRON TAXIWAY 2

General Condition - Good

Nineteen of 63 slabs were cracked, but 14 of these occurred as centerline longitudinal cracks similar to those found on the primary taxiway. It was felt that most of these cracks did not fully qualify as major defects. Five other outer-lane slabs were also found to be cracked. All cracks were unsealed. Most exhibited incipient spalling. (See Figures A-19, A-20, and A-21). Less than one percent minor defects were noted. Joint seals and shoulders were in excellent condition.

APRON TAXIWAY 3

General Condition - Excellent

Three of 57 slabs (5 percent) contained major structural defects. All three failed slabs were in the center lane and all failed generally in longitudinal cracking. Almost no unrepaired minor defects were found. Nine slabs showed patched areas (AC or epoxy concrete) in excess of one square foot in area. Patches were in generally very good condition. Joint seals and shoulders were in excellent condition.

APRON TAXIWAY 4

General Condition - Excellent

Only one slab (center lane) of a total of 54 was found to have cracked (transversely). An insignificant number of minor defects were noted. Joint seals and shoulders were in excellent condition.

PAVEMENT CONDITION SURVEY

APRON TAXIWAY 5

General Condition - Excellent

No major and no minor defects were found. Joint seals and shoulders were in excellent condition.

APRON TAXIWAY 6

General Condition - Excellent

No major defects were found. Thirteen percent of all slabs showed minor defects such as small unrepaired spalls, popouts, and embedded wood. Joint seals and shoulders were in excellent condition.

PARKING APRON A

General Condition - Excellent

Only thirty of over 3,600 total slabs (less than one percent) contained major structural defects. These defects occurred in groups and only in the taxiing lanes of the apron (See Figure A-22). Less than two percent of all slabs contained minor defects, usually small unrepaired joint spalls, popouts, and embedded wood. Joint seal was in excellent condition.

PARKING APRON B

General Condition - Excellent

Thirty five (1.3 percent) of the 2,690 total slabs in Apron B contained major structural defects. Twenty eight of these cracked slabs occurred in an almost continuous row along one of the center taxiing lanes of the parking apron. The remainder were grouped in the area where turns are made on and off Apron Taxiway 3. A record search showed that concrete test beam strengths did not appear low for the failed-slab paving lane.

Very few minor defects were found in Apron B (less than 1 percent of all slabs). Joint seals were in excellent condition.

PARKING APRON C & HANGAR ACCESS APRON

General Condition - Excellent

No major defects were noted on either apron. Less than one percent of all slabs had minor defects, mostly popouts and embedded wood fragments. Joint seals were in excellent condition.

PAVEMENT CONDITION SURVEY

PARKING APRON D

General Condition - Excellent

Infrequent minor defects were noted, mostly very small longitudinal joint spalls with a few popouts (less than 4 percent of all slabs contained minor defects). No major defects were found. Joint seal was in excellent condition. Asphaltic concrete shoulders were in excellent condition.

RTN APRON

General Condition - Excellent

No major defects were noted. Approximately 5 percent of all slabs contained very minor defects. Shoulders and joint seals were in excellent condition.

NORTH WARM-UP APRON

General Condition - Excellent

Only one slab (less than 1 percent) was found to have a structural defect. Less than 6 percent of all slabs showed evidence of minor defects, mostly embedded wood. Joint seals were in excellent condition. Seals and pavement showed no damage due to jet blast.

SOUTH WARM-UP APRON

General Condition - Excellent

Eleven of approximately 240 slabs (5 percent) showed major structural defects (cracking). An insignificant number of slabs had minor defects. Joint seals were in excellent condition.

HARDSTANDS 1 THROUGH 3 (REBUILT)

General Condition - Excellent

No major defects noted. Minor defects ranged from 4 to 7 percent of all slabs. Joint seals contain some small aggregate but are in excellent condition. Concrete shoulders are in excellent condition.

PAVEMENT CONDITION SURVEY

HARDSTANDS 4 THROUGH 8

General Condition - Excellent

Only one major defect noted in these hardstands, an unsealed transverse crack in Hardstand 4. Considerable minor defects, mostly very small spalls, were noted and ranged in occurrence from 15 percent of slabs in Hardstand 7 to 70.5 percent of all slabs in Hardstand 8. These minor defects are not detrimental to aircraft operation. Joint seal contained small aggregate but was rated excellent. Concrete shoulders were in excellent condition.

HARDSTANDS 9 THROUGH 23; 29 THROUGH 31

General Condition - Excellent

One major defect, an unsealed transverse crack, was noted in Hardstand 11. Most hardstands had less than 10 percent of all slabs effected by minor defects, usually small spalls, with some popouts and embedded wood. Many hardstands exhibited considerable gouging and scratching of the pavement surface, to depths of approximately 1/4 to 1/2-inch. Concrete shoulders were in excellent condition. Joint seals contained considerable small aggregate but were rated excellent.

NORTH POWER CHECK PAD

General Condition - Excellent

Only one cracked slab was noted on this pad. Three slabs evidenced what appeared to be a repair of a large corner spall at their intersection. Less than 1 percent of all slabs had very minor joint spalls. Joint seal was in excellent condition.

SOUTH POWER CHECK PAD

General Condition - Excellent

A total of six slabs (4.5 percent of all slabs) were cracked. Four of these cracked slabs were sealed and were located at the intersection with Access Taxiway 2, and in areas where taxiing aircraft are common. A few extremely minor occurrences of small joint spalls were also noted. Joint seal was in excellent condition with a few cases of blown seal due to jet blast.

DATE: July 1968

SUMMARY OF DATA – RIGID PAVEMENT CONDITION SURVEY

AIRFIELD: U-TAPAO, Thailand

FEATURE	SLAB SIZE FT	APPROX NO OF SLABS	PAVE THICK IN	NO. OF SLABS CONTAINING INDICATED DEFECTS															% OF SLABS NO DEFECTS	% OF SLABS NO MAJOR DEFECTS	CONDITION
				|	—	\	△	✳	~	W	⌐	⌐	J	⊕	M	P	O	C			
Runway 18-36	25 x 25	3680	18& 14	42	18	-	34			278	87	15	19				70		85	98	Excellent
Main Taxiway	25 x 25	1274	18& 16	98	24	-	1			31	28	7	5		7		10		84	90	Excellent*
Access Taxiway 1	25 x 25	378	18& 16	-	-	-	-			6	5	6	-		2		2		95	100	Excellent
Access Txy2(West)	25 x 25	180	16	7	31		1			2	10	-	-				1		76	82	Poor**
Access Txy2(East)	25 x 25	186	18& 16	-	-	-	-			3	4	-	-						97	100	Excellent
Hardstand Taxiway 1	25 x 25	438	18& 16	3	14	2	2			7	44	7	-				6		81	96	Excellent
Hardstand Taxiway 2	25 x 25	342	16	-	2	1	-			9	30	2					6		85	99	Excellent
Hardstand Taxiway 3	25 x 25	315	18& 16	-	-	-	-			19	1	-	-				8		91	100	Excellent
Hardstand Taxiway 4	25 x 25	99	18& 16	-	-	-	-			-	-	-	-				-		100	100	Excellent
Cross Taxiway 1	25 x 25	78	18	-	-	-	-			3	2	-	-				-		94	100	Excellent

REMARKS: * Longitudinal centerline cracking was not considered a major defect in rating this pavement facility. (See narrative and "Comments")

** Most cracks occurred in center (or travelled) lane.

LEGEND:

| LONGITUDINAL CRACK	~ SHRINKAGE CRACK	⊕ SETTLEMENT
— TRANSVERSE CRACK	W EMBEDDED WOOD	M MAP CRACKING
\ DIAGONAL CRACK	⌐ SPALL ON TRANSVERSE JOINT	P PUMPING JOINT
△ CORNER BREAK	⌐ SPALL ON LONGITUDINAL JOINT	O POP OUT
✳ SHATTERED SLAB	J CORNER SPALL	C UNCONTROLLED CONTRACTION CRACK

DATE: July 1968

SUMMARY OF DATA – RIGID PAVEMENT CONDITION SURVEY

AIRFIELD: U-TAPAO, Thailand

FEATURE	SLAB SIZE FT	APPROX NO OF SLABS	PAVE THICK IN	NO OF SLABS CONTAINING INDICATED DEFECTS															% OF SLABS NO DEFECTS	% OF SLABS NO MAJOR DEFECTS	CONDITION
				|	–	\	△	✳	~	W	ʃ	ʃ	J	⊕	M	P	○	C			
Cross Taxiway 2	25 x 25	78	14	–	–	–	–			1	2	–	–				2		94	100	Excellent
Cross Taxiway 3	25 x 25	78	14	–	–	–	–			–	–	–	–				–		100	100	Excellent
Cross Taxiway 4	25 x 25	78	18	2	2	–	1			2	–	–	–				3		90	96	Excellent
Apron Taxiway 1	25 x 25	378	14	–	–	–	–			6	5	6	–				2		95	100	Excellent
Apron Taxiway 2	25 x 25	63	14	19	1	–	–			2	1	–	–				–		65	70	Good*
Apron Taxiway 3	25 x 25	57	14	3	1	–	–			–	–	–	–				–		95	95	Excellent
Apron Taxiway 4	25 x 25	54	14	–	1	–	–			1	–	–	–						96	98	Excellent
Apron Taxiway 5	25 x 25	75	16	–	–	–	–			–	–	–	–				1		99	100	Excellent
Apron Taxiway 6	25 x 25	84	14	–	–	–	–			2	–	6	–				3		87	100	Excellent
Parking Apron A	25 x 25	3648	14& 12	23	6	–	2			16	18	2	–				16		98	99	Excellent

REMARKS:

*Longitudinal centerline cracking was not considered a major defect in rating this pavement facility (see narrative and "comments")

LEGEND:

|	LONGITUDINAL CRACK	~	SHRINKAGE CRACK	⊕	SETTLEMENT
–	TRANSVERSE CRACK	W	EMBEDDED WOOD	M	MAP CRACKING
\	DIAGONAL CRACK	ʃ	SPALL ON TRANSVERSE JOINT	P	PUMPING JOINT
△	CORNER BREAK	ʃ	SPALL ON LONGITUDINAL JOINT	○	POP OUT
✳	SHATTERED SLAB	J	CORNER SPALL	C	UNCONTROLLED CONTRACTION CRACK

DATE: July 1968

SUMMARY OF DATA – RIGID PAVEMENT CONDITION SURVEY

AIRFIELD: U-TAPAO, Thailand

FEATURE	SLAB SIZE FT	APPROX NO OF SLABS	PAVE THICK "	NO OF SLABS CONTAINING INDICATED DEFECTS															% OF SLABS NO DEFECTS	% OF SLABS NO MAJOR DEFECTS	CONDITION
				|	—	\	△	✳	~	W	⊥	⊥	J	⊕	M	P	O	C			
Parking Apron B	25 x 25	2690	14	31	3	-	1			7	12	1	-				16		97	99	Excellent
Parking Apron C	25 x 25	1176	16, 14, 12,	-	-	-	-			5	3	-	-				2	-	99	100	Excellent
Parking Apron D	25 x 25	700	14& 12	-	-	-	-			-	-	25	-				2		96	100	Excellent
RTN Apron	25 x 25	168	14& 12	-	-	-	-			4	-	4	-				-		95	100	Excellent
Hangar Access Apron	25 x 25	234	12	-	-	-	-			-	2	-	-				-		99	100	Excellent
N. Warm-up Apron	25 x 25	220	16	1	-	-	-			7	3	-	-				2		94	99	Excellent
S. Warm-up Apron	25 x 25	240	12	9	2	-	2			1	-	-	-				4		93	95	Excellent
Hdst 1,2,3 17-23,29-31	25 x 25	351	18& 16	-	-	-	-			8	4	-	-				4		95	100	Excellent
Hdst 4 thru 16	25 x 25	351	16	-	3	-	-			2	50	12	-				2		80	99	Excellent
N&S Power Check Pads	25 x 25	294	16	2	2	-	2			-	5	-	-				-		96	98	Excellent

REMARKS:

LEGEND:

| LONGITUDINAL CRACK	~ SHRINKAGE CRACK	⊕ SETTLEMENT
— TRANSVERSE CRACK	W EMBEDDED WOOD	M MAP CRACKING
\ DIAGONAL CRACK	⊥ SPALL ON TRANSVERSE JOINT	P PUMPING JOINT
△ CORNER BREAK	⊥ SPALL ON LONGITUDINAL JOINT	O POP OUT
✳ SHATTERED SLAB	J CORNER SPALL	C UNCONTROLLED CONTRACTION CRACK

Figure A-1. Longitudinal crack and corner break, Runway 18-36 at Cross Taxiway 2, Ban U-Tapao Airfield.

Figure A-2. Cracking in Runway 18-36 at Cross Taxiway 2, Ban U-Tapao Airfield.

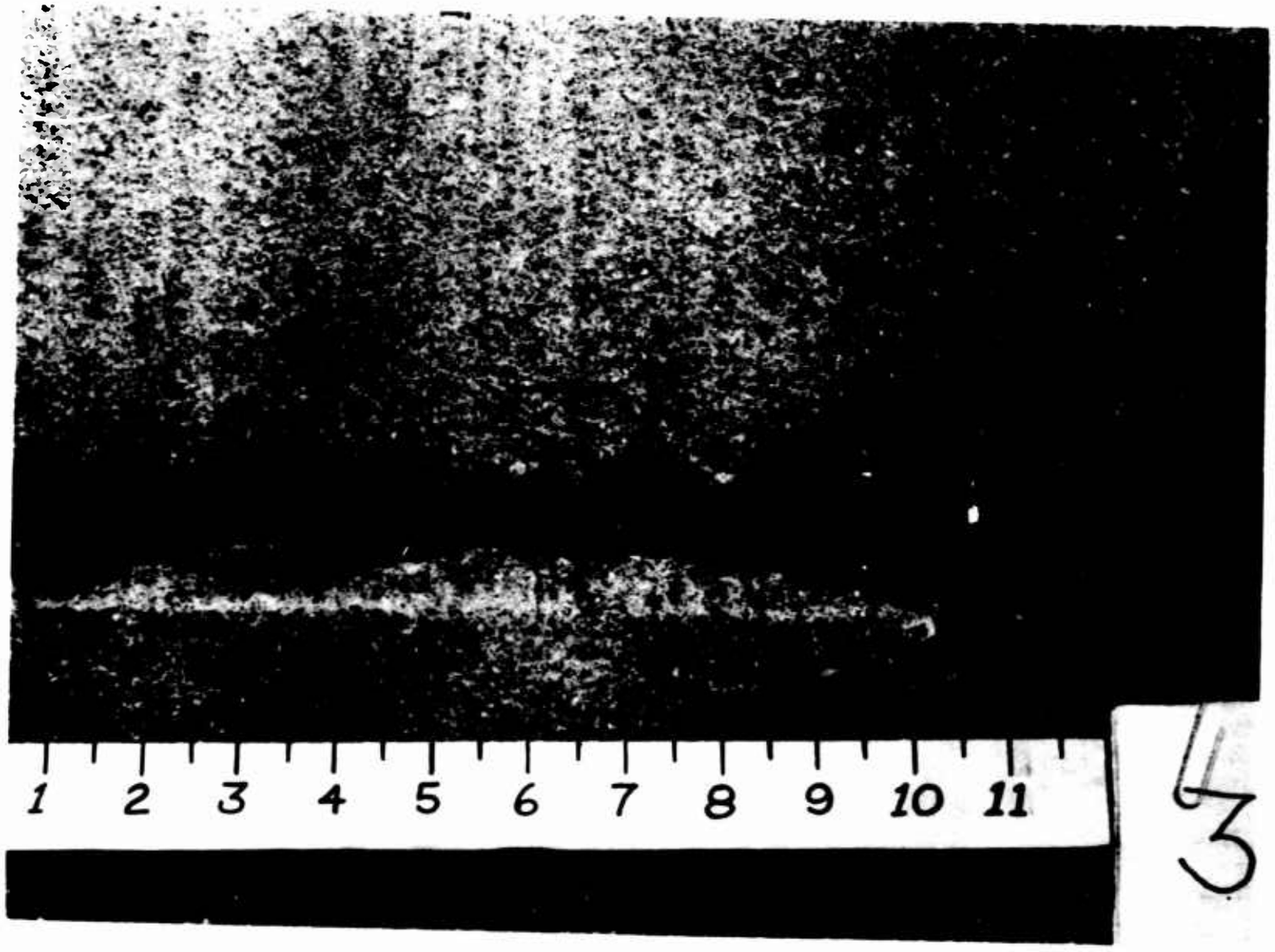

Figure A-3. Typical minor transverse spalls, Runway 18-36, Ban U-Tapao Airfield.

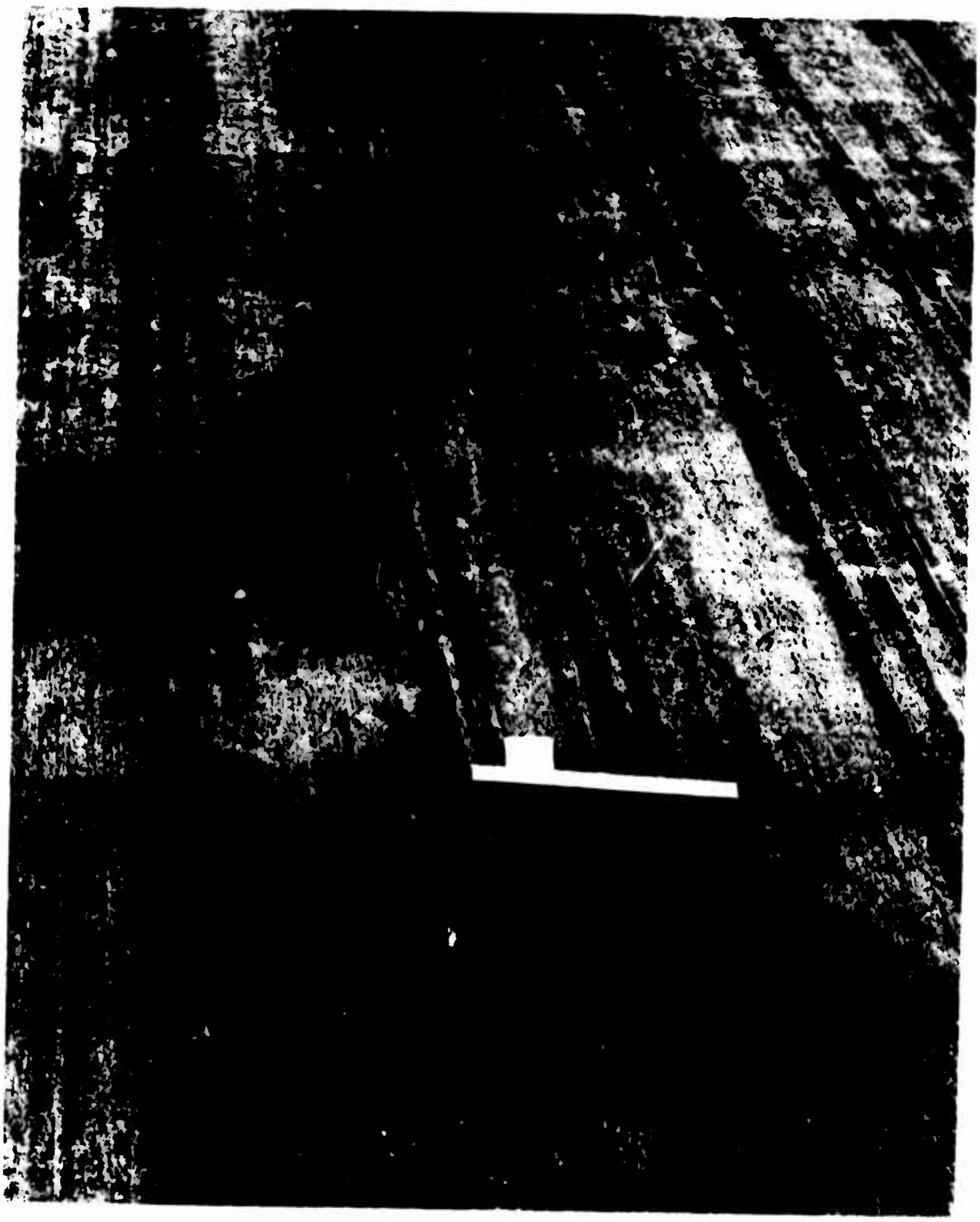

Figure A-4. Unsealed longitudinal crack, suspected klong area of Runway 18-36 (Sta 55 + 250), Ban U-Tapao Airfield.

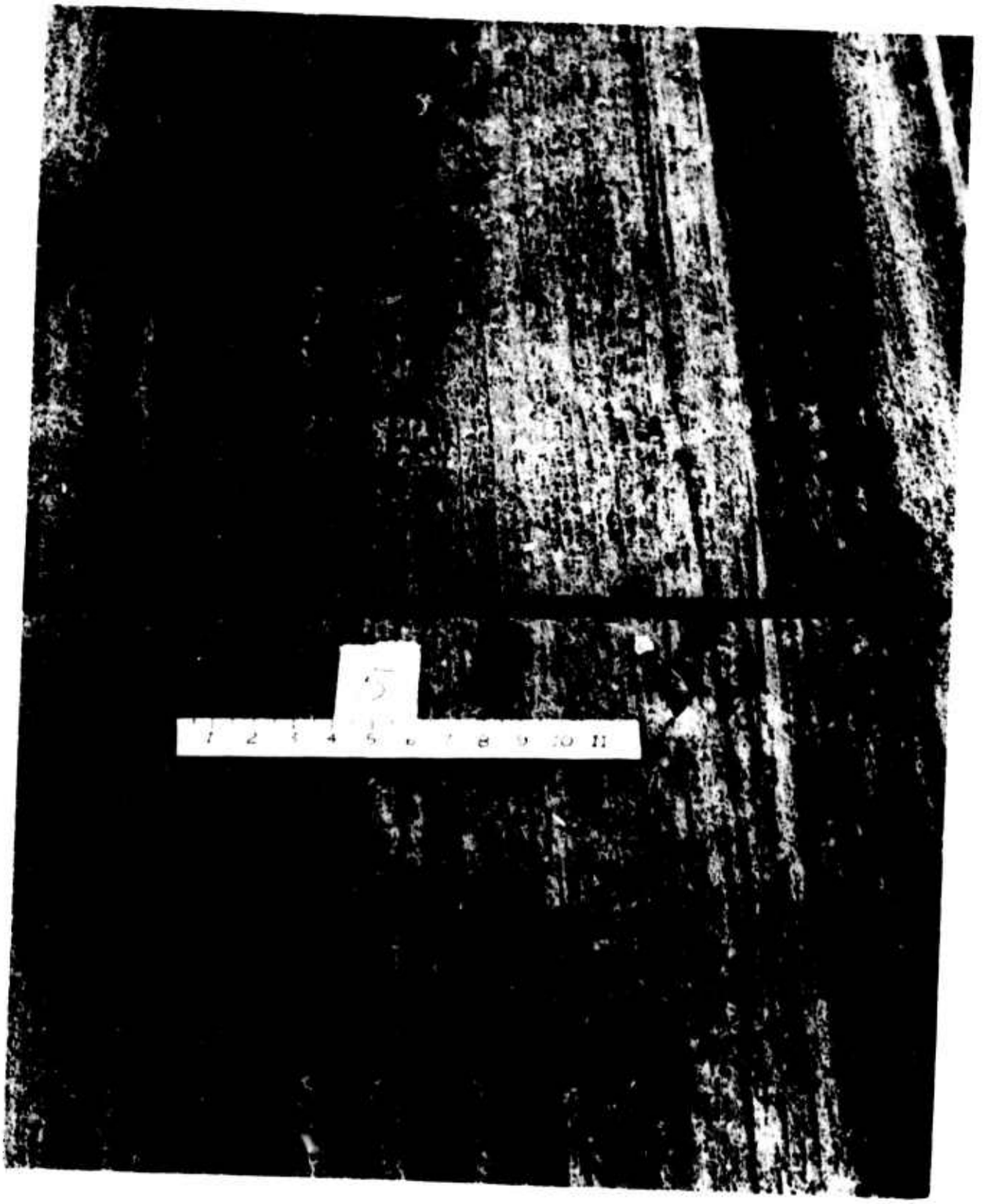

Figure A-5. Longitudinal cracks with spalls in suspected klong area (Sta 55 + 250) of Runway 18-36, Ban U-Tapao Airfield.

Figure A-6. Typical centerline longitudinal crack in Primary Taxiway, Ban U-Tapao Airfield.

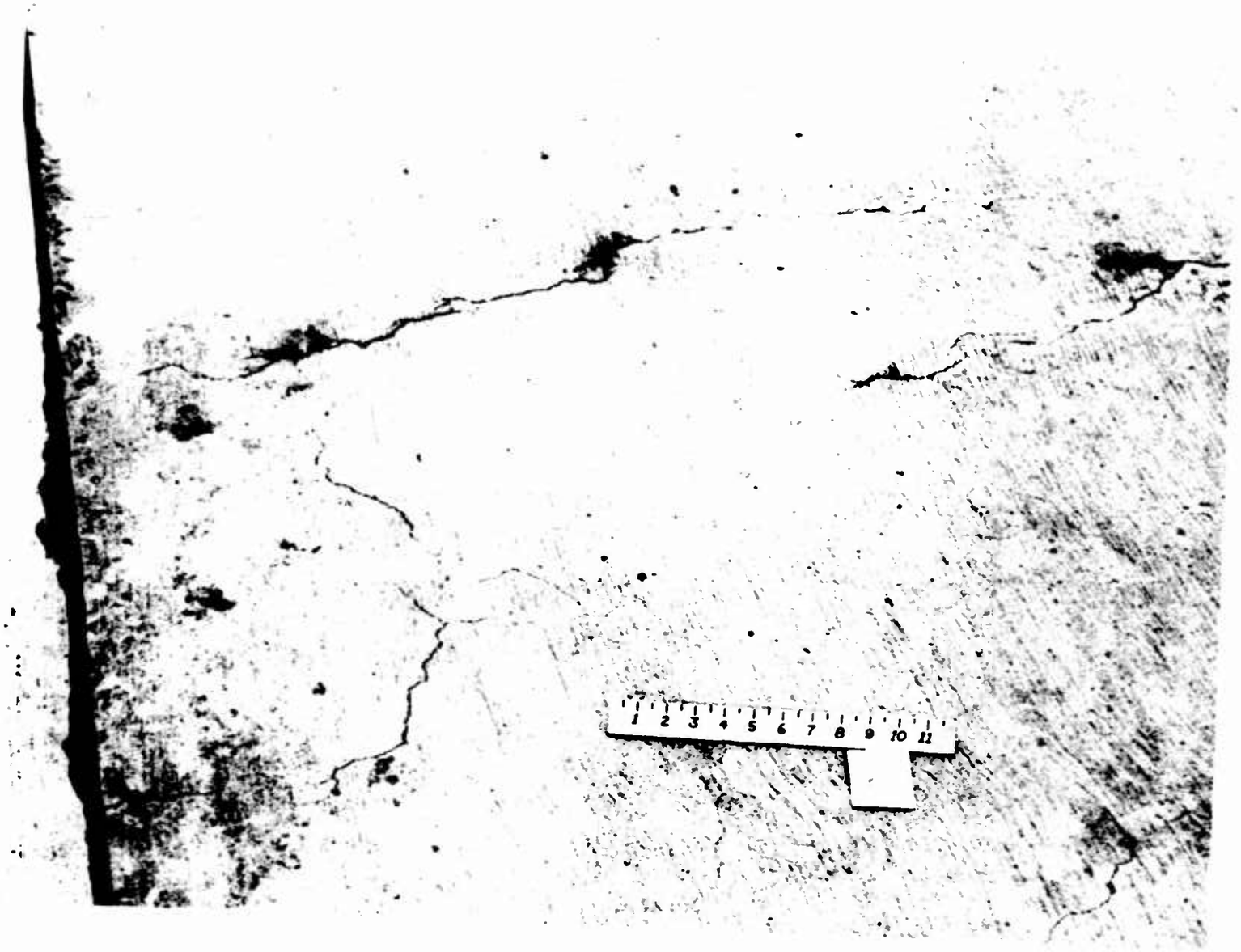

Figure A-7. Typical map cracked slab in Primary Taxiway, Ban U-Tapac Airfield.

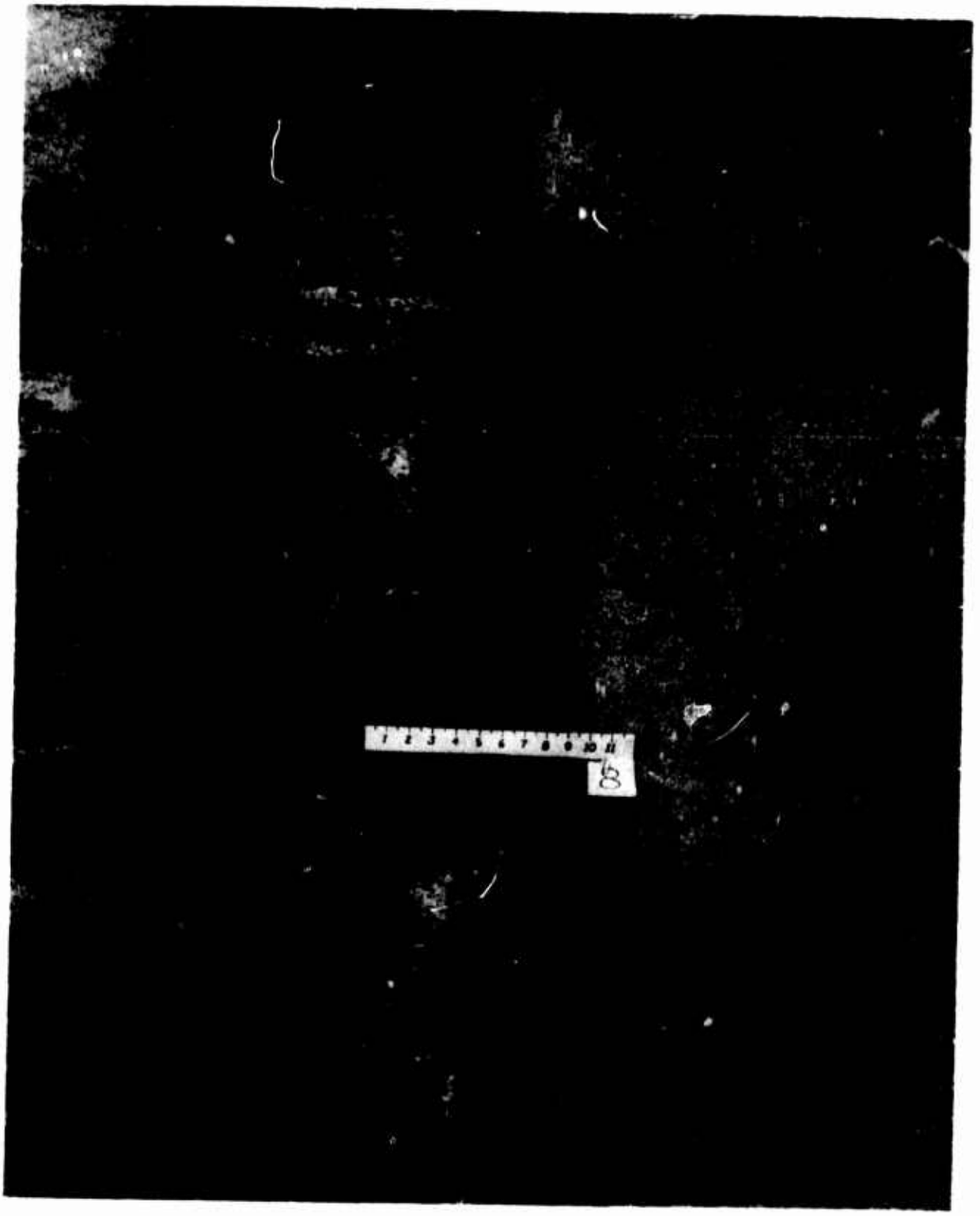

Figure A-8. Typical hot mix AC patch of transverse joint spall on Primary Taxiway, Ban U-Tapao Airfield.

Figure A-9. Typical hot mix AC and epoxy concrete patches, Primary Taxiway, Ban U-Tapao Airfield.

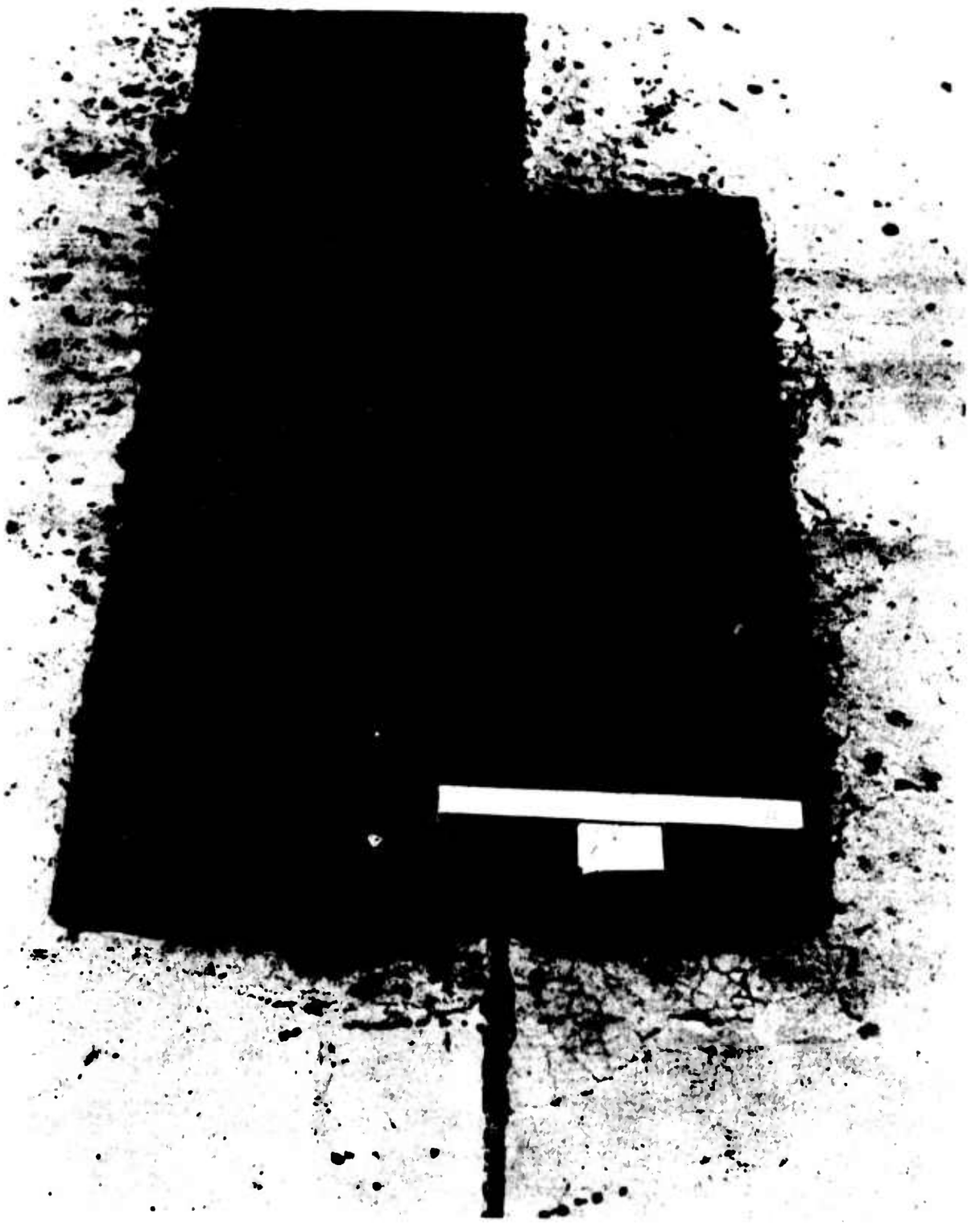

Figure A-10. Epoxy concrete patch with hairline cracking and incipient spalling at edge, Primary Taxiway, Ban U-Tapao Airfield.

Figure A-11. Evidence of standing water and sealed transverse crack in Access Taxiway 2, Ban U-Tapao Airfield.

Figure A-12. Series of sealed transverse cracks looking toward Runway 18-36 on Access Taxiway 2, Ban U-Tapao Airfield.

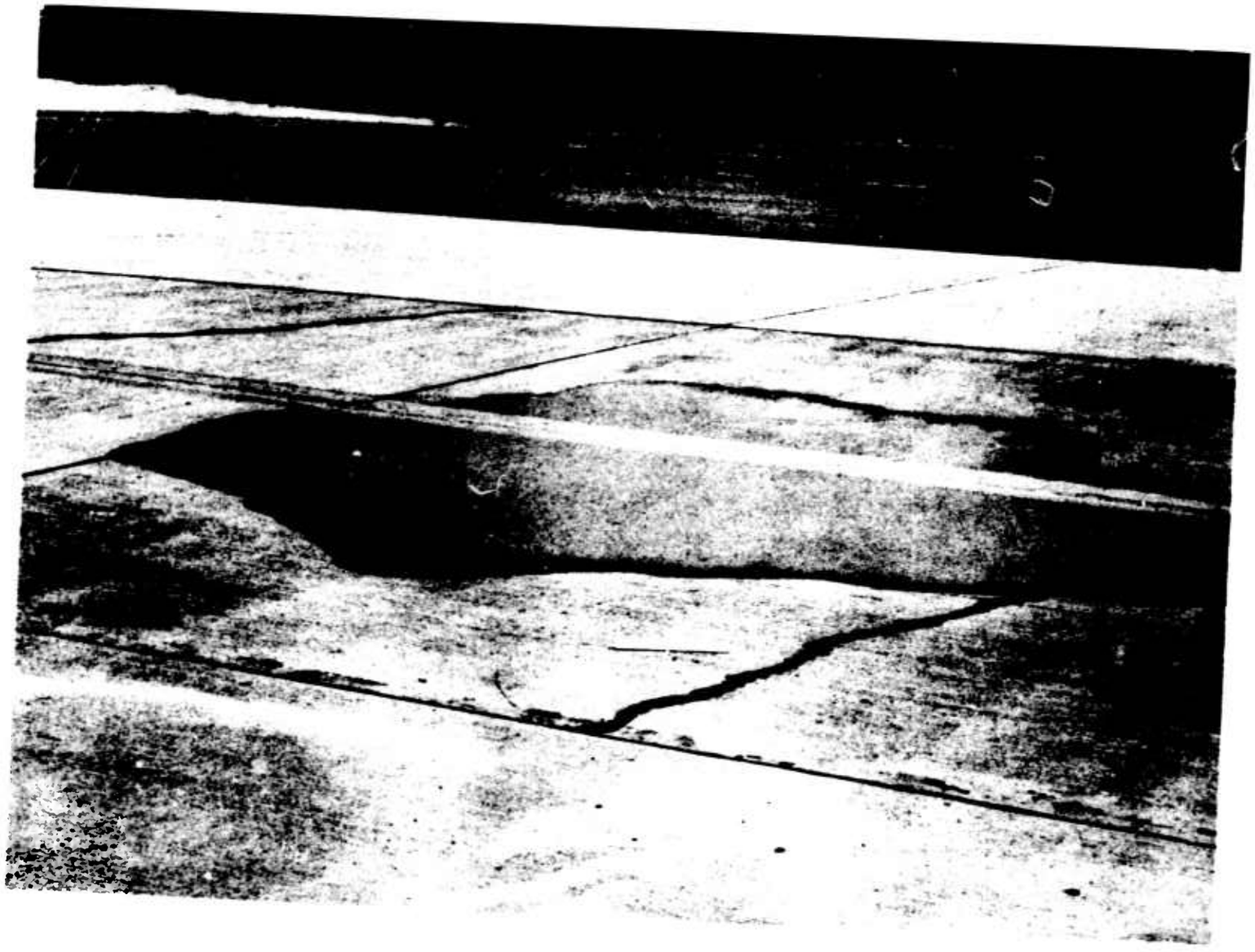

Figure A-13. Standing water pond and sealed transverse crack in slab at transition from flat to crowned section, Access Taxiway 2, Ban U-Tapao Airfield.

Figure A-14. General view showing cracking and standing water in Access Taxiway 2, Ban U-Tapao Airfield.

Figure A-15. Typical unsealed transverse crack in Hardstand Taxiway 1, Ban U-Tapao Airfield.

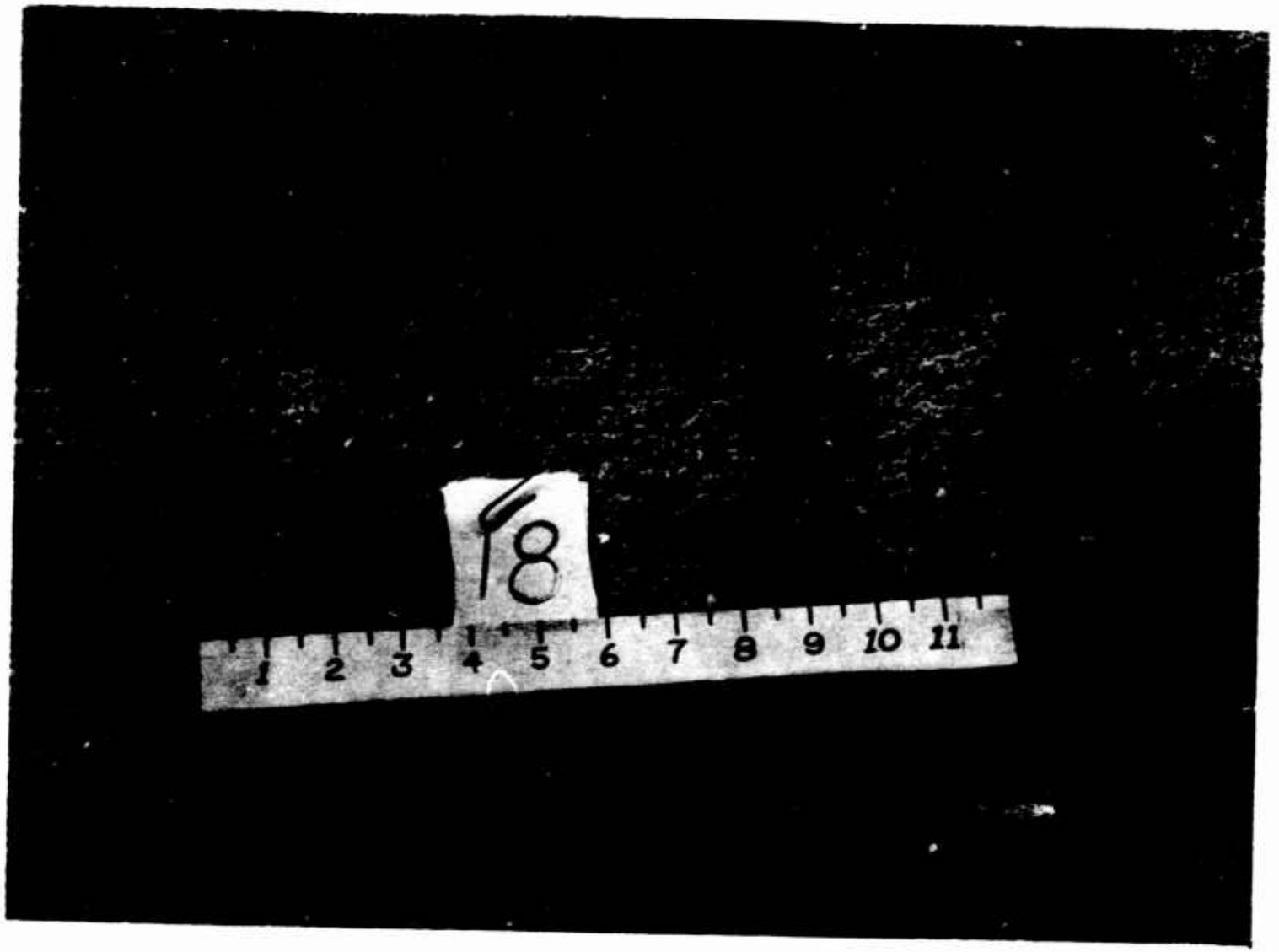

Figure A-16. Small aggregate embedded in joint sealer, Hardstand Taxiway 3, Ban U-Tapao Airfield.

Figure A-17. Eight-inch diameter cores taken from Hardstand Taxiway 4, Ban U-Tapao Airfield.

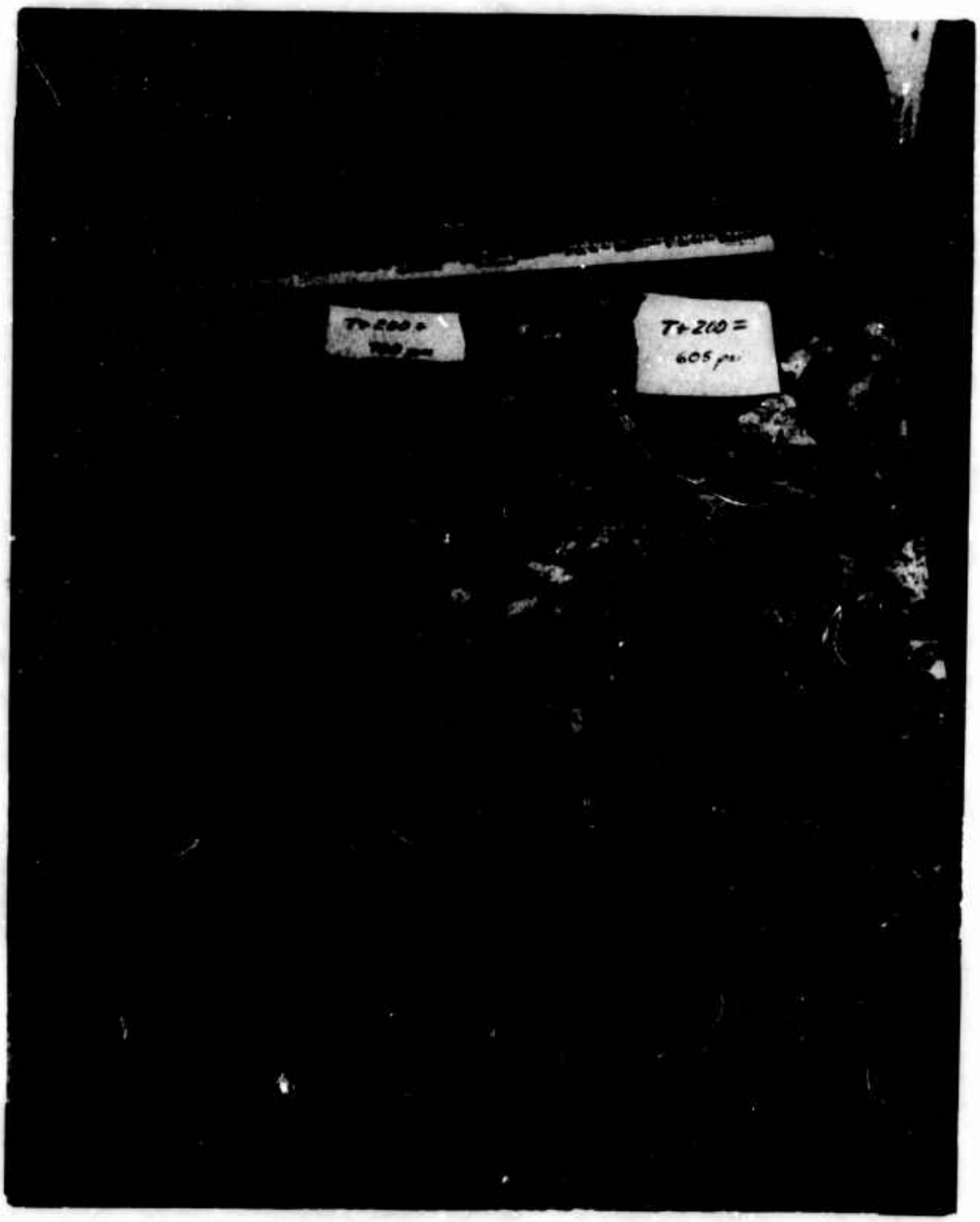

Figure A-18. Two eight-inch diameter cores after tensile splitting tests, Hardstand Taxiway 4, Ban U-Tapao Airfield.

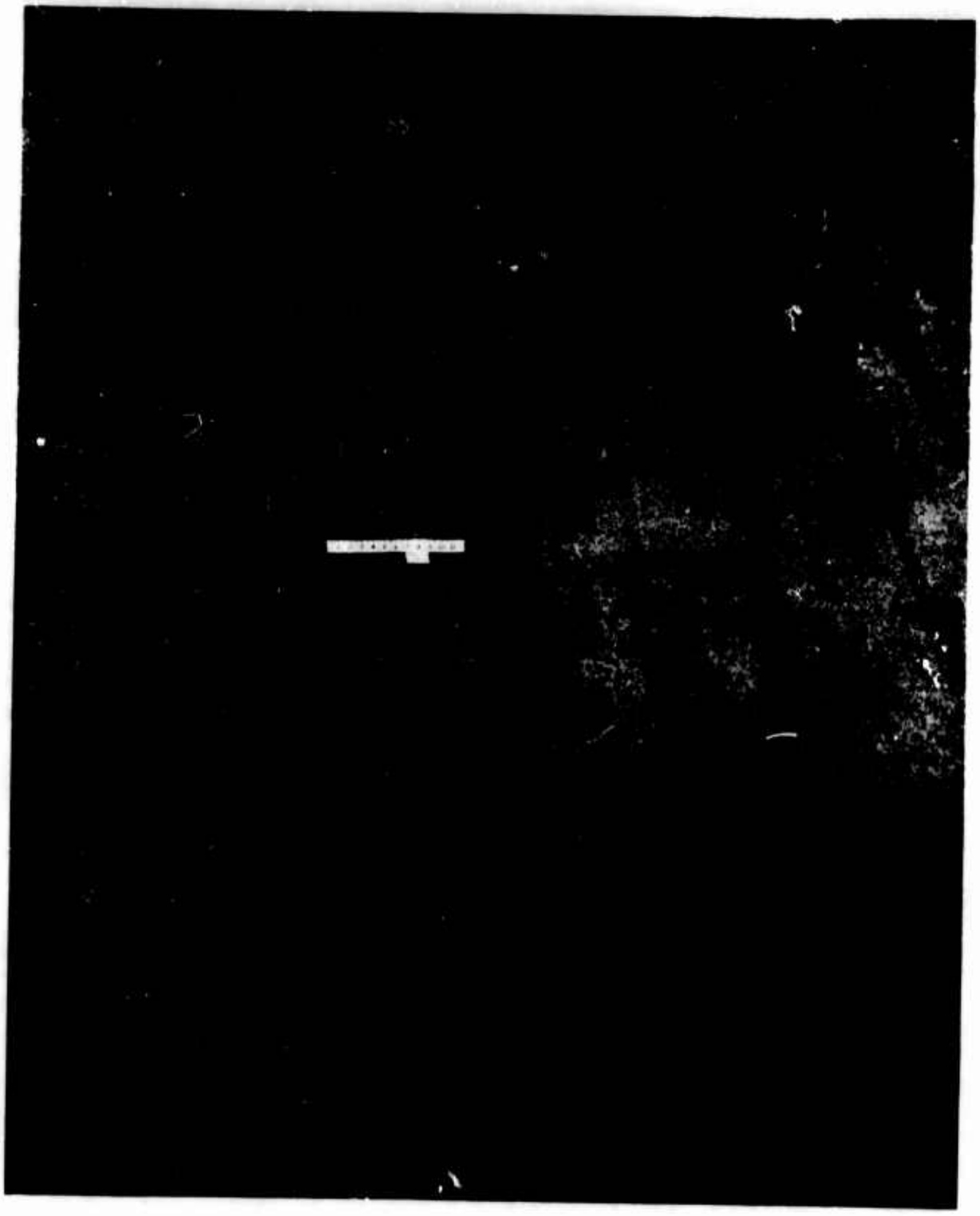

Figure A-19. Typical unsealed longitudinal crack in Apron Taxiway 2, Ban U-Tapao Airfield.

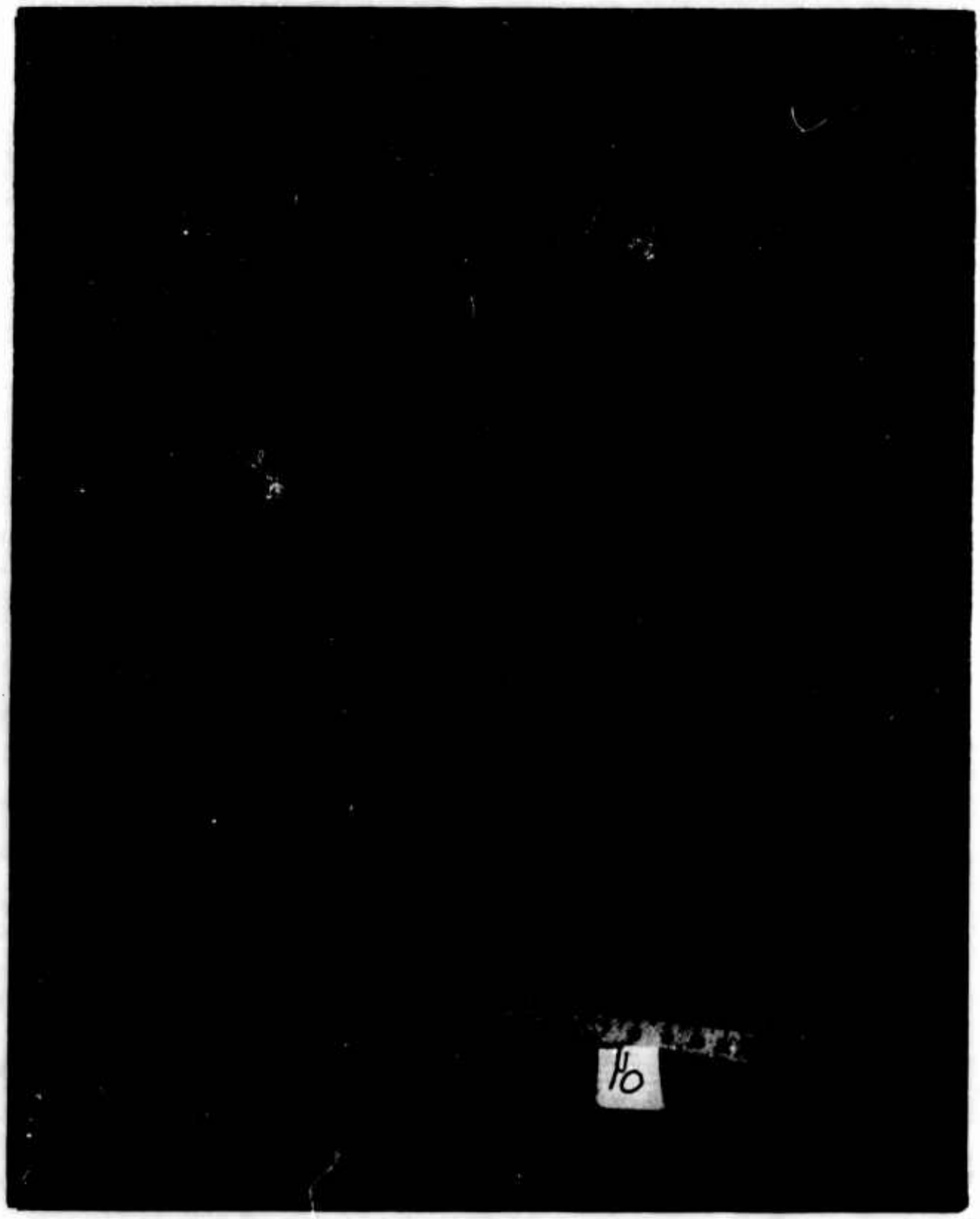

Figure A-20. Severe unsealed longitudinal crack in Apron Taxiway 2, Ban U-Tapao Airfield.

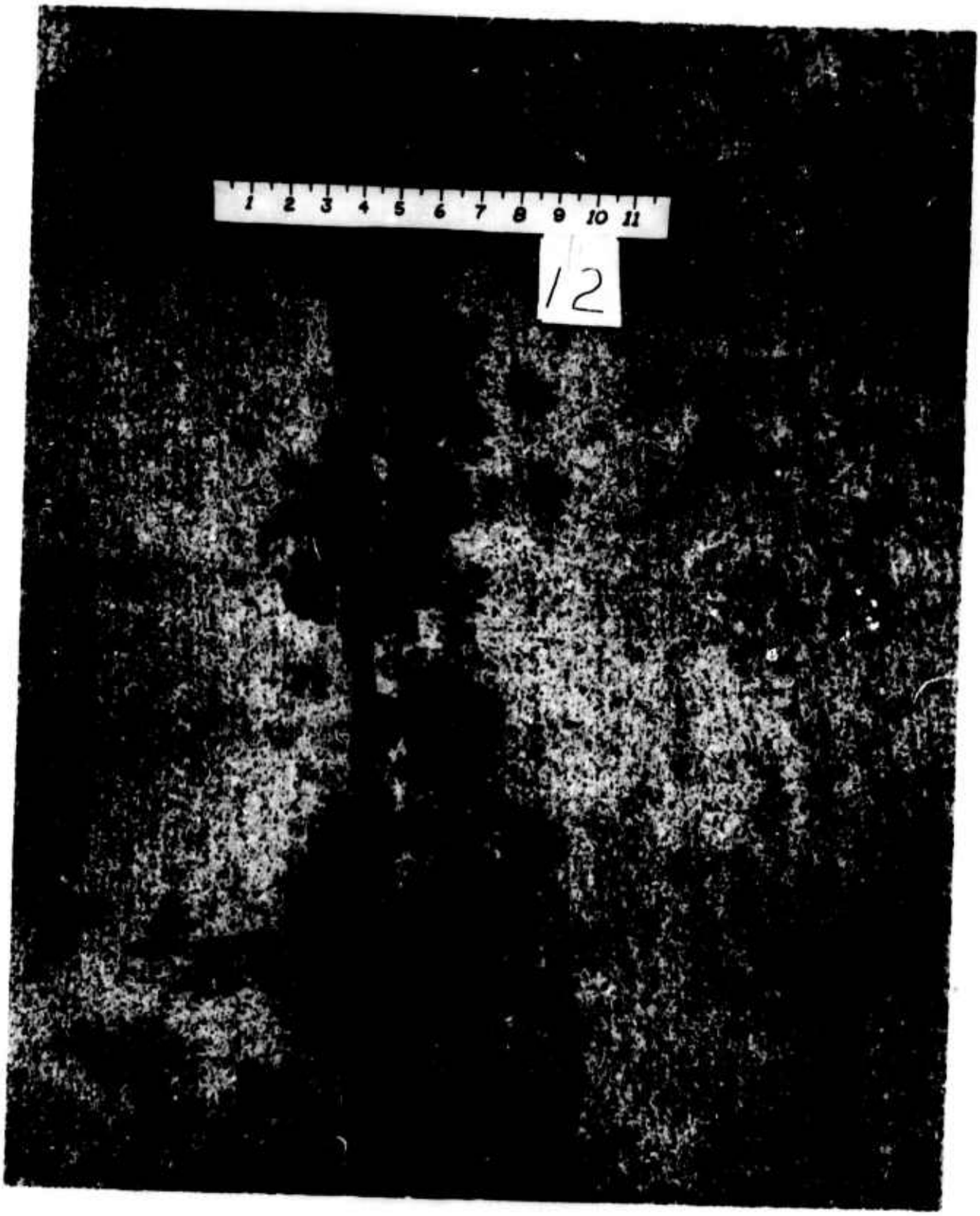

Figure A-21. Small joint spalls on longitudinal joint, Apron Taxiway 2, Ban U-Tapao Airfield.

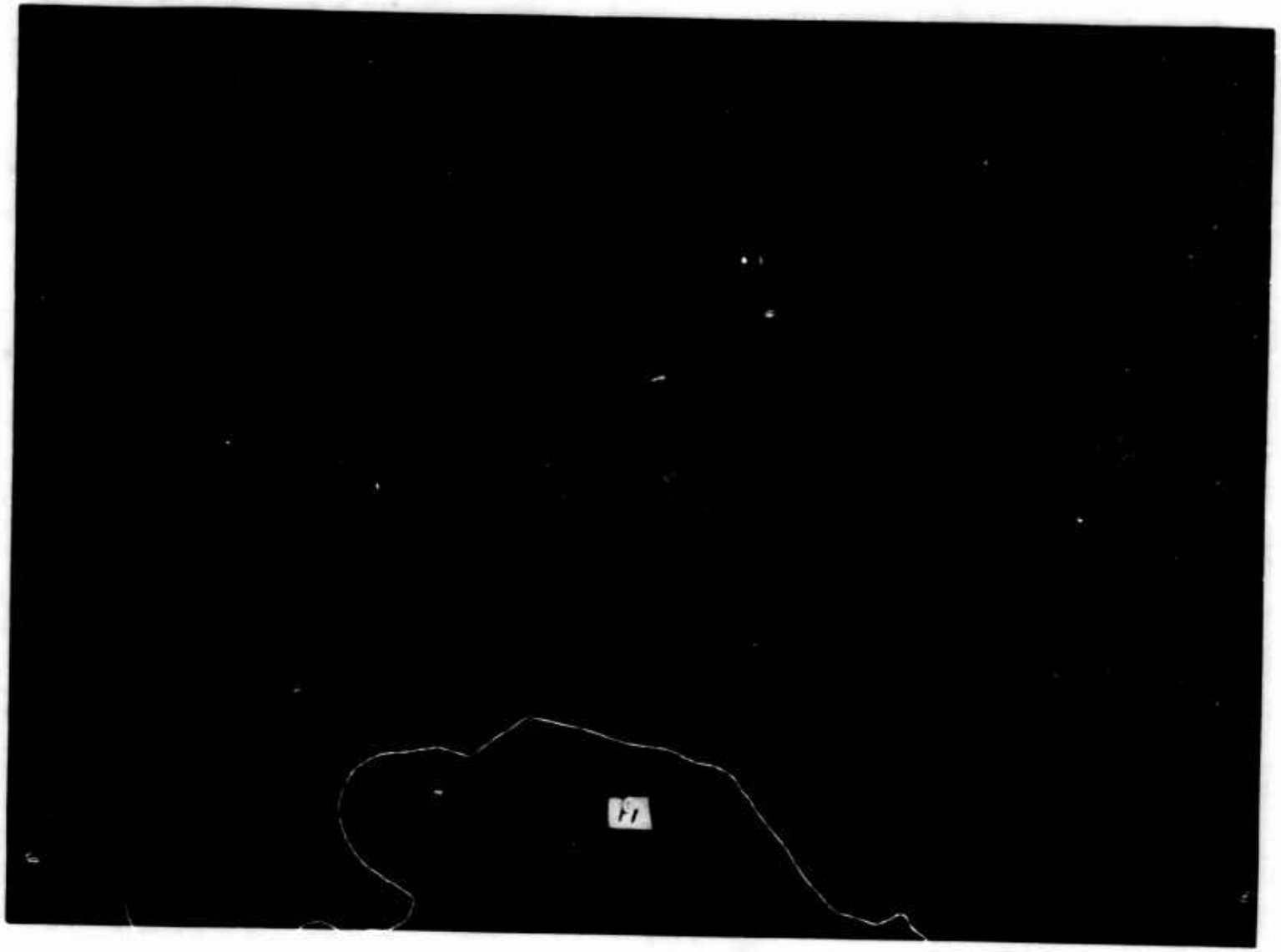

Figure A-22. Severe cracking and spalling of slab in Parking Apron A near Apron Taxiway 2, Ban U-Tapao Airfield.

REFERENCES

1. Royal Thai Naval Air Station - Ban U-Tapao, Soils and Foundation Report, NBy 73038, Louis Berger - Von Storch and Burkavage.

2. Airfield Pavement Evaluation Report, Ban U-Tapao Air Base, Thailand, OICC-Bangkok (L. Trigg), 1967.

3. Ohio River Division Laboratories. Miscellaneous Paper No. 5-7: Basis for Rigid Pavement Design for Military Airfields, by R. L. Hutchinson. Cincinnati, Ohio, May 1966.

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Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Naval Civil Engineering Laboratory Port Hueneme, California 93041	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

Airfield Pavement Evaluation, Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

2 June 1968 to 28 August 1968

5. AUTHOR(S) (Last name, first name, initial)

Lambiotte, D. J. and Brownie, R. B.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
August 1968	61	3

8a. CONTRACT OR GRANT NO. b. PROJECT NO. 53-005 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

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13. ABSTRACT

The evaluation of the pavement at the Royal Thai Navy Station, Ban U-Tapao Airfield, Thailand is presented with the allowable gross load capacities of all airfield pavements for various aircraft gear configurations. Included is a narrative-type pavement condition survey with a defect summary and supplementary photographs.

DD FORM 1 JAN 64 1473 0101-807-6800

Unclassified
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14 KEY WORDS	LINK A		LINK B		LINK C	
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